





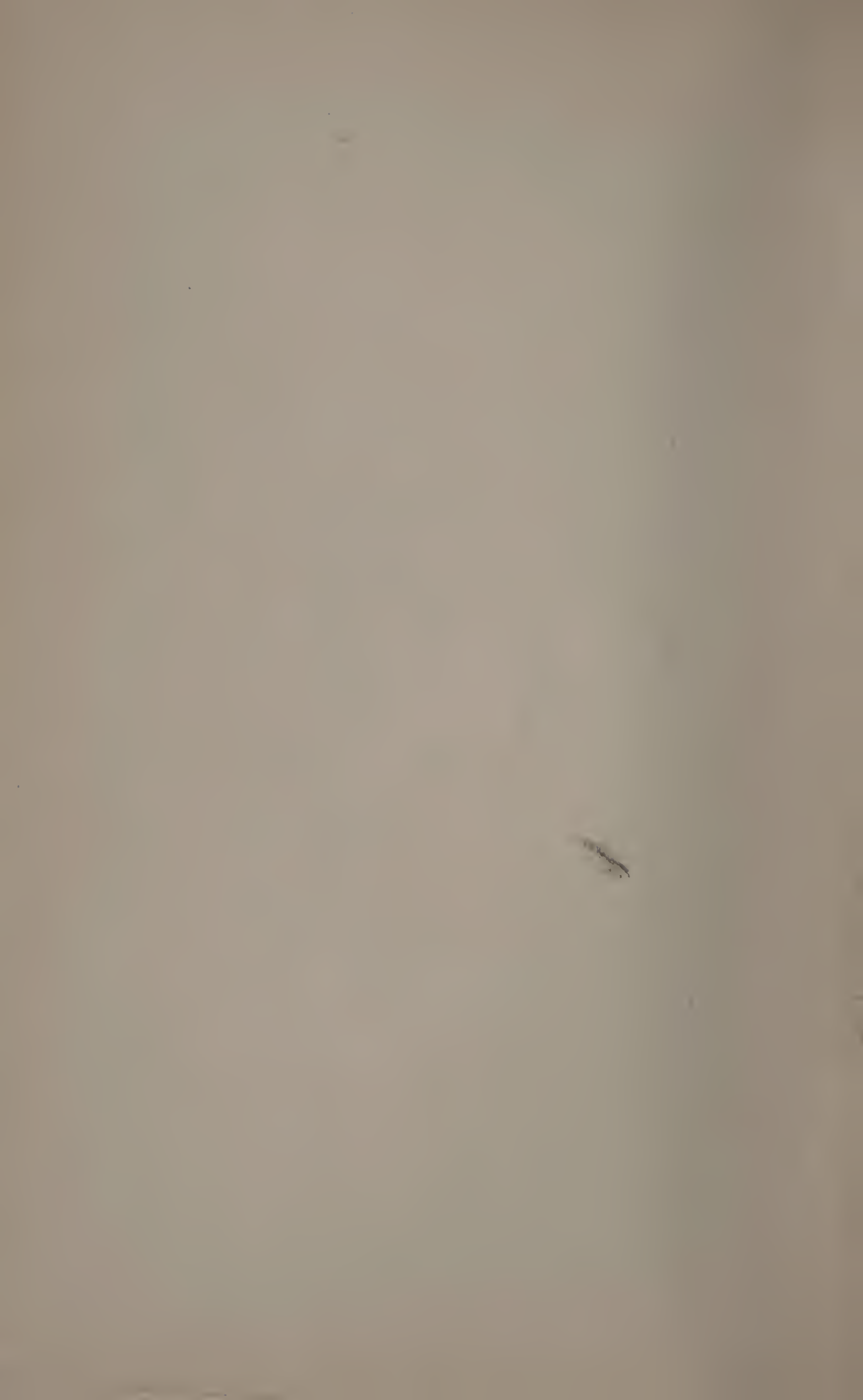
Class TR 455

Book M33

Copyright N<sup>o</sup> copy 2

COPYRIGHT DEPOSIT.







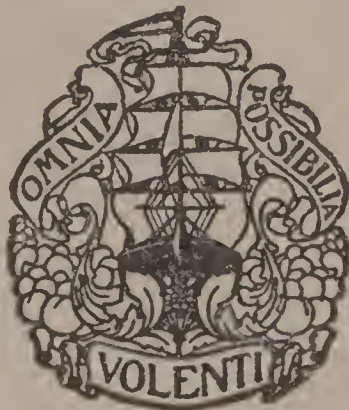
# BROMOIL PRINTING AND BROMOIL TRANSFER

BY  
DR. EMIL MAYER

PRESIDENT OF THE VIENNA CLUB OF AMATEUR PHOTOGRAPHERS

*AUTHORIZED TRANSLATION  
FROM THE SEVENTH GERMAN EDITION*

BY  
FRANK ROY FRAPRIE, S.M., F.R.P.S.  
EDITOR OF AMERICAN PHOTOGRAPHY



AMERICAN PHOTOGRAPHIC PUBLISHING CO.,  
BOSTON 17, MASSACHUSETTS  
1923

TR 455  
.M33  
Copy 2

COPYRIGHT, 1923  
BY AMERICAN PHOTOGRAPHIC PUBLISHING CO.

*Manufactured in the United States of America*  
*Electrotyped and printed, March, 1923*

23-10689

THE PLIMPTON PRESS  
NORWOOD · MASS · U · S · A

JUN 22 '23

©CIA705902

## PREFACE

THE bromoil process has always been one in which it has seemed difficult to attain success. Though many books and articles on the subject have been published, every writer seems to give different directions and every experimenter to have difficulty in following them. The consequence is that almost every successful experimenter with this process has developed methods of his own and has frequently been unable to impart them to others. One reason for this has been that each make of bromide paper varies in its characteristics from the others and that methods, which are successful with one, do not always succeed with another. Various bleaching solutions have been described, and, as the bleaching solution has two functions—bleaching and tanning, which progress with different speeds at different temperatures—a lack of attention on this point has doubtless been a frequent cause of unsucccess. Little attention has also been paid to the necessity for observing the temperature of the water used for soaking the print. The author of the present book has investigated these various points very carefully, and for the first time, perhaps, has brought to the attention of the photographic reader the need for an accurate knowledge of the effect of these different variables.

In the following book he describes only a single method of work, without variations until the process is learned, though he does describe various methods of

work which may be used to vary results by the experienced worker. His method of instruction is logical and based on accepted educational principles. He describes one step at a time fully and carefully, explains the reasons for adopting it, and then proceeds to the next step in like manner. We feel sure that every reader, who will be reasonably careful in his methods of work and will follow these instructions literally, will learn how to make a good bromoil print. After attaining success in this way, the variations may be tried, if desired.

While the author gives instructions for testing out papers to see if they are suitable, it may be advisable to record here the results of some American and English workers. H. G. Cleveland in *AMERICAN PHOTOGRAPHY* for February, 1923, recommends, in addition to the papers specially marked by their makers as bromoil grades, the following: Eastman Portrait Bromide; P. M. C., Nos. 7 and 8; and Wellington, Cream Crayon Smooth, Rough, or Extra Rough. He suggests that a rough test may be made of a new brand of paper by placing a small test strip in water at 120° to 140° Fahrenheit for a few minutes and then scraping the emulsion surface with a knife blade. If the coating is entirely soft and jelly-like, it will probably be suitable for the process. If it is tough and leathery, it will be unsuitable, and, if a portion of the coating is soft but the other portion tough, then it will also be unsuitable. His experience is that Wellington Bromoil paper is entirely suitable for the process. Chris J. Symes in *The British Journal of Photography* for December 1, 1922, recommends for bromoil the following English papers: Kodak Royal, white and toned; Vitegas, specially prepared for bromoil; Barnet Cream Crayon



## PREFACE

v

Natural Surface, Rough Ordinary and Tiger Tongue. For transfer, he has found the following suitable: Kodak Royal, white and toned; Kodak Velvet; Barnet Smooth Ordinary; and Barnet Semi-matt Card.

The reader who is interested in bromoil transfer, will find the directions of Mr. Guttman on this process slightly different from those of Dr. Mayer in minor points, but the worker who is far enough advanced to essay this difficult process will be able to recognize these discrepancies and choose the process which seems more useful to himself.

Metal etcher's presses for transfer are sold at comparatively high prices in the United States, but second hand ones may often be found in the larger cities. Small wooden mangles with maple rolls may be had at fairly low prices from dealers in laundry supplies, and have been found to be useful.

Following the style of the German original, italics have been freely used for the purpose of calling attention to the most important stages of the process, rather than for the ordinary purposes of emphasis.

Grateful acknowledgment is made to Mr. E. J. Wall for assistance in the first draft of the translation, and also in revision of the proofs.

FRANK ROY FRAPRIE.

BOSTON, February, 1923.

# CONTENTS

	PAGE
PREFACE . . . . .	iii
CONTENTS . . . . .	vi
PRELIMINARY REMARKS . . . . .	i

## CHAPTER I

PRODUCTION OF THE BROMIDE PRINT — Definition of Perfect Print — The Choice of the Paper — Development — Control of the Silver Bromide Print — Fixation . . . . .	10
--	----

## CHAPTER II

THE REMOVAL OF THE SILVER IMAGE — Bleaching — The Intermediate Drying . . . . .	29
---	----

## CHAPTER III

THE INKING-UP — The Production of the Differential Swelling — The Properties of the Relief and Its Influence on the Character of the Picture — Effect of Warm Water — Effect of Ammonia — The Utensils — Brushes — The Inks — The Support — Removal of the Water from the Surface of the Print — The Brush Work — Use of Dissolved Inks — Use of Rollers — Resoaking of the Print during the Working-up — Removal of the Ink from the Surface — Failures — Alteration of the Character of the Picture by the Inking — The Structure of the Ink — Different Methods of Working — Hard Ink Technique (Coarse-grain Prints) — Soft Ink Technique — Sketch Technique — Large Heads — Oil Painting Style — Night Pictures — Prints with White Margins — The Swelled-grain Image — Mixing the Inks — Polychrome Bromoils . . . . .	38
--	----

## CHAPTER IV

AFTER-TREATMENT OF THE FINISHED PRINT — Defatting the Ink Film — Retouching the Print — Refatting of the Print — Application of Ink to Dry Prints . . . . .	104
---	-----

# CONTENTS

vii

PAGE

## CHAPTER V

TRANSFER METHODS — Simple Transfer — Combination Transfer with One Print-plate — Shadow Print — High Light Print — Combination Transfer from Two Prints .	115
---	-----

## CHAPTER VI

OIL vs. BROMOIL . . . . .	134
---------------------------	-----

## CHAPTER VII

BROMOIL TRANSFER, by Eugen Guttmann — The Bromoil Print — The Choice of the Paper — The Machine — Printing — Combination Printing with One Bromoil — The Value of Combination Printing — Retouching and Working-Up — Drying . . . . .	142
---	-----

## CHAPTER VIII

THE PREPARATION OF BROMOIL INKS, by Eugen Guttmann — The Varnish — Powder — Colors — Tools — Practice of Ink Grinding — Ink Mixing — Permanency — Ink Grind- ing Machines. . . . .	176
---	-----





# BROMOIL PRINTING AND BROMOIL TRANSFER

## PRELIMINARY REMARKS

WE all know what great progress photography has made in the last few years. The most obvious sign of this advance is the fact that it has gradually escaped from the practice of literal reproduction of the objects seen by the lens, and slowly attained to the rank of a recognized means of artistic expression, so that it can justly be considered as a new branch which has grown out of the old tree of reproductive art. This pleasing development may primarily be ascribed to the fact that the practice of photography, which was originally confined almost exclusively to professional workers, has gradually spread and has become a means of recreation to the multitude in their leisure hours. It was the amateur who demanded new methods and apparatus and thus gave a new impulse to photographic manufacturing. Improvements of the most fundamental character were made in optical apparatus, in the construction of cameras of the most varied types, and in the fabrication of plates and films. An extraordinary number of novelties has appeared in these lines in the course of time; modern photographic apparatus makes possible the solution of problems which would not have been attempted a few years ago, and improvements are still appearing.

The situation in the matter of printing processes is quite different. We are provided with apparatus and sensitive material for the production of the photographic

negative, in a perfection which leaves nothing to be desired. To produce a print from the negative, however, we had until recently no positive processes which were not well-known to previous generations. This may be confirmed by a glance at any photographic textbook written around 1880. The various printing processes, platinum, bromide, carbon, and gum, which were until recently the alpha and omega of printing technique, had been known for decades. Compared with the methods for the production of negatives, printing methods showed practically no advance; they remained in complete stagnation. We can scarcely consider as an exception certain new methods brought forward in recent years, which proved unsuccessful and quickly disappeared from practice.

These facts can only be explained by remembering that the positive processes, which were available to photographers and with which they had to be satisfied, were rather numerous and offered a considerable variety of effects. Nevertheless, a single characteristic was common to all previously known photographic printing processes — their inflexibility. Each of these processes, in spite of its individual peculiarities, could do nothing more than exactly reproduce the negative which was to be printed. It was possible to produce certain modifications of the negative image as a whole, by printing it darker or lighter, or by using a harder or softer working process. Changes on the negative itself for the purpose of giving a more artistic rendering must, however, always be very carefully thought out in advance and effected by retouching, often difficult and not within the power of every photographer, or by other methods which change the negative itself. If such modifications of the

negative proved unsuccessful, it was irreparably lost; if they succeeded, the plate, as a rule, could no longer be used in any different manner. The possibility of undertaking radical changes which might realize the artistic intentions of the worker on the print itself, in order to save the negative, and especially of planning and carrying out the deviations from the original negative, which expressed the worker's artistic feelings, during the printing, was not afforded by any previously known printing methods. A single exception was found in gum printing, if the production of the image was divided into a series of partial printings. Each of these phases, however, was in itself incapable of modification except for the possibility of doing a certain small amount of retouching; nevertheless, by means of efficient management of the single printings and by properly combining them, beautiful artistic effects could be obtained. This, however, required an extraordinary amount of practice and skill, and a very considerable expenditure of time, and it must also be remembered that the failure of one of the last printings often destroyed all the previous work. Also, in gum printing, to have a reasonable expectation of success, the work must be thought out from the very beginning and carried out in exact accordance with a plan from which it was scarcely possible to deviate during the work, even when it became apparent that the desired result could not be satisfactorily obtained.

The possibility of planning results during the course of the printing and carrying them out directly on the print itself did not previously exist.

The first process to bring us nearer to this ideal and make possible a freer method of working was oil printing. The technique of this process consisted in sensitizing



paper which had been coated with a layer of gelatine, by means of a solution of potassium bichromate, and of printing it under the negative. The yellowish image was then washed out; the bichromate had, however, produced various degrees of tanning of the gelatine, corresponding to the various densities of the silver deposit in the negative. The lighter portions, which had been protected from the action of light by the dense parts of the negative, retained their original power of swelling and could therefore later absorb water. The shadows, however, corresponding to the transparent parts of the negative, were tanned, had lost their absorptive power, and had become incapable of taking up water. Consequently, the high lights swelled up fully in water, the shadows remained unchanged, and the middle tones showed various degrees of swelling corresponding to the gradation of the negative. If the print was blotted off and greasy inks spread upon it by means of a properly shaped brush, the inks were entirely repelled by the swollen high lights which had absorbed water, and completely retained by the fully tanned shadows, while the middle tones, in proportion to the amount of tanning, retained or repelled the greasy ink more or less completely.

In this process, for the first time, there was found a possibility of changing various parts of the image absolutely at the worker's will, even during the progress of the work. By the use of harder or softer inks it was possible to color the swollen high lights more deeply, or to hold back the shadows so that they did not take up all the ink that was possible. It was possible to leave certain parts of the print entirely untouched and work up other parts to the highest degree; in short, oil

printing opened the way to free artistic handling of the print.

Thus, the oil process was the first photographic printing process in which we were completely emancipated from the previous inflexibility which ruled in all printing.

Nevertheless, a number of disadvantages attach to oil printing which hinder its general use. The most important shortcoming of this process is that bichromated gelatine as a printing medium can only reproduce a comparatively short scale of tone values. The production of prints from contrasty negatives is therefore impossible, for the shadows are much overprinted before details appear in the high lights, or on the other hand, there is no detail in the lights if the shadows are fully printed. This difficulty can be only partly overcome by the most skilful use of inks of various consistency. It is indeed possible to ink up the lights by the use of very soft ink, but this does not replace the missing details; and overprinted shadows, which it is tried to improve by keeping down the quantity of ink applied, appear empty. Thus it happens that most of the oil prints yet exhibited show a certain muddy family likeness, which, at first, when the process was new, was considered to be advantageous on account of the novelty of the effect, but later received deserved criticism. A second disadvantage of the oil print is the fact that it is not possible to observe the progress of the printing on the bichromated gelatine film. The brownish image on a yellow background is very deceiving, and it is usually necessary to determine the proper amount of printing for each individual negative by actual experiment, and to make additional prints by means of a photometer.

Another inconvenience of other previously known

printing processes, to which oil printing is also subject, comes from the fact that the great majority of negatives are now made with small cameras. On account of the extraordinary perfection of modern objectives, the small negatives produced by modern hand cameras can be enlarged practically without limit. The advantages of a portable camera are so considerable that large and heavy tripod cameras have practically gone out of use, except for certain special purposes. On the other hand, however, direct prints from small negatives are, as a rule, entirely unsatisfactory from an artistic standpoint. If we desire to use any of the previously mentioned positive processes, including oil, to produce artistic effects, we must first make an enlarged negative. This requires, in the first place, the production of a glass transparency from the small negative, from which we may prepare the desired enlarged working negative.

Various workers held various views as to whether this requirement were a help or a hindrance, but it was universally accepted as a necessity. The way from the plate to the enlarged negative, nevertheless, always remained uncertain, tedious, and expensive. Simple as it may appear to be, it includes a whole series of stages where it is possible to come to grief. At every single step lurks the danger that undesired changes of gradation in the negative may result from inaccuracy in exposure and development, from the use of improperly chosen sensitive material, and from various other causes, and even if these factors are all correctly handled, there is still an unavoidable loss of detail. Therefore the path from the small original negative to the enlarged negative necessary in previously used processes is neither simple nor safe.



Naturally it was also necessary to travel this wearisome path in working the oil process, when it was desired to make large prints from small negatives.

When it was announced in England that Welborne Piper had discovered a process which started from a finished silver bromide print instead of from a gelatine film sensitized with bichromate, new vistas were opened. If the process should prove to be practically useful, we could consider that all the previously mentioned difficulties were overcome at a single stroke.

The principle of this process, *bromoil printing*, is the removal of the silver image from a finished silver bromide print by means of a bleaching solution while, simultaneously with the solution of the silver image, the gelatine film is tanned in such a way in relation to the previously present image that the portions of gelatine which represent the high lights of the image preserve their capability of swelling, while the shadows of the image are tanned.

*Therefore the bromoil process is a modification of oil printing, based not upon a bichromated gelatine film, but upon a completed bromide print.* This represents extraordinary progress. The two previously mentioned disadvantages of oil printing are completely avoided in the bromoil process. We now have at our command the far longer scale of tone values of bromide paper and we can use the great possibilities of modification allowed by the highly developed bromide process. The difficulties of printing are completely removed, for we have at our command a perfectly visible image as a starting point. A further advantage which can not be too highly estimated is inherent in the bromoil process: *complete independence of the size of the original negative.*

When I began my investigations in the field of bromo-oil printing, the process had, as far as practical value went, only a purely theoretical existence, as is the case in the early days of most photographic processes. The fact that it was possible to produce images on a bleached bromide print by the application of greasy inks was well established. The practical application of the process was absolutely uncertain and only occasionally were satisfactory results obtained. Most of the prints produced in this way were flat and muddy. It is easy to understand that the process could find no widespread popularity while it was so incompletely worked out. The researches, which I then began, showed that most bromide papers took up greasy inks after development by any method and subsequent bleaching of the image. The pictures thus obtained, however, were muddy, flat, and not amenable to control, and therefore were less satisfactory than the bromide prints from which I had started. During the course of my work, I have succeeded in obviating these difficulties, in the first place, by preparing a satisfactory bleaching solution, next, by determining what properties bromide paper must possess in order to give perfect bromo-oil prints, and, finally, by working out a series of other necessary conditions, which I have described in this book and which must be adhered to if the process is to work smoothly and certainly, and produce satisfactory results.

The bromo-oil process, which is now completely mastered, offers, in brief, the following advantages:

Simplicity, certainty and controllability of the printing material;

Independence of the size of the negative and easy production of enlarged artistic prints;



Freedom in the choice of basic stock and its surface;

The possibility of freely producing on the print any desired deviations from the negative, during the work;

Full mastery of the tone values without dependence on those of the negative;

Independence of daylight, both in printing and in working up the print;

The possibility of the most radical alterations of the print as a whole and in part during the work;

Freedom of choice of colors;

The possibility of preparing polychromatic prints with any desired choice of colors, and complete freedom in the handling of the colors;

The possibility of comprehensive and harmonious modifications of the finished print;

The possibility of producing prints on any desired kind of non-sensitized paper by the method of transfer.

The description of working methods will be divided into the following phases:

- I. Production of the bromide print;
- II. Removal of the silver image;
- III. Application of the ink;
- IV. After-treatment of the finished print.

## CHAPTER I

### PRODUCTION OF THE BROMIDE PRINT

*FAILURES in the bromoil process in the great majority of cases can be ascribed to the fact that the basic bromide print was not satisfactory. Therefore the method of preparation of the bromide print or enlargement deserves the most careful consideration, for the bromide print is the most important factor in the preparation of a bromoil print. The beginner, especially, can not proceed too carefully in making his bromide print.*

Because of the extraordinary importance of this point, we must first define what is here meant by a perfect bromide print.

In deciding how to produce a satisfactory bromide print as a basis for a bromoil, we must exclude from consideration esthetic or artistic grounds.

*The bromide print must be technically absolutely perfect, that is, it must have absolutely clean high lights, well graded middle tones, and dense shadows. Especial stress must be laid on the brilliancy of the high lights. It is best to compare these high lights with an edge of the paper which has not been exposed and is not fogged or, even better, with the back of the paper. The highest lights should show scarcely a trace of a silver precipitate and must therefore be almost as white as the paper itself. Negatives which do not allow of the production of prints as perfect as this should not be used while the bromoil process is being learned.*

## PRODUCTION OF THE BROMIDE PRINT 11

This apparently superfluous definition of a perfect bromide print has to be given in this way, because it only too often occurs in practice that *the worker himself is not clear as to what is meant by the expression, perfect bromide print*. This may be partly ascribed to the fact that the silver bromide process — whether rightly or wrongly need not be determined here — has not been properly appreciated among amateurs who are striving for artistic results. Bromide printing has frequently been considered not to be satisfactory as an artistic means of expression, and has therefore been considerably neglected. In many quarters it is considered as just good enough for beginners.

Nevertheless, the bromide process is *per se* an uncommonly flexible method and gives, even with a very considerable amount of overexposure or underexposure, that is, even when very badly handled, results which are considered usable. It is even possible that an improperly made bromide print, one for instance, which is soft and foggy, might in some circles be considered as esthetically more interesting than a perfect print. This is an undeniable advantage of the process. It may also become a danger, if an imperfect bromide print is used as a starting point in the bromoil process. If anyone is not sure on this point, let him compare his own bromide prints with such samples as are frequently shown by manufacturers in window displays and sample books. He will then see what richness of tones and wealth of gradation are inherent in the process. *If, however, an imperfect silver bromide print is used as a starting point for a bromoil, it can not be expected that the latter will display all the possibilities of this process*. If the bromide print is muddy, the work of inking will be dif-

ficult, and it will be impossible to obtain clean high lights. If it is underexposed and too contrasty, it can not be expected that the bromoil will show details in the high lights which were lacking in the bromide print. If the worker himself does not know that his silver bromide print is faulty, he is inclined to ascribe the difficulties which he finds in making the bromoil print and his dissatisfaction with the results, to the bromoil process itself. Most of the unsatisfactory results in bromoil work must be ascribed to the imperfect quality of the bromide print which is used, and this is the more important as this lack is not perceptible to the eye after the bleaching is completed. *Whoever, therefore, desires to successfully practice bromoil printing, must first decide impartially and critically whether he actually knows how to make bromide prints, and must acquire full mastery of this process.*

The technically perfect bromide print made from a properly graded negative can, as will later be described, have its gradations changed in the bromoil process without any difficulty, and thus be made softer or more contrasty. The advanced bromoil printer who is a thorough master of the technique of the process will therefore easily be able to work even with poor negatives; when making his bromide prints from such negatives, he will consider the ideas which he intends to incorporate in the bromoil print and will make his bromide print harder or softer than the negative and at the same time retain the necessary cleanness of the high lights.

The best starting point for a bromoil print, however, especially for the beginner, is and must be a bromide print as nearly perfect as possible.



A suggestion for the certain obtaining of such prints may be added here. When we are working with a negative with strong high lights, judgment as to the freedom of the bromide print from fog by comparison with an unexposed edge is not difficult. This is not the case with negatives which show no well marked high lights. In such cases it is advisable to *determine what is under-exposure* by making test strips in which details in the high lights and middle tones are lacking and, working from this point, determine by gradual increase of exposure the correct time which gives a perfectly clean print.

THE CHOICE OF THE PAPER. — One of the most important problems is to find a suitable paper for the process. Not all of the bromide papers which are on the market will give satisfactory results. *It is only possible to use papers whose swelling power has not been too completely removed in process of manufacture by the use of hardeners.* The principle of the bromoil process is that a tanning of the gelatine shall occur simultaneously with the bleaching of the silver bromide image. As we have already remarked, this does not affect the high lights and leaves them still absorbent, while the shadows are tanned and therefore become incapable of taking up water. The half-tones are tanned or hardened to an intermediate degree and therefore can take up a certain amount of water. *Therefore, in place of the vanished silver image, we get a totally or partially invisible tanned image in the gelatine film.*

The variously hardened parts of the gelatine film, corresponding to the various portions of the vanished bromide image, display the property acquired through different degrees of tanning by the fact that the portions

of the gelatine which remain unhardened and which correspond to the high lights of the silver image formerly present, absorb water greedily. Consequently they swell up and acquire a certain shininess, because of their water content; in addition they generally rise above the other parts of the gelatine film, which contain little or no water, and give a certain amount of relief when they are fully swelled. The portions of the film in which the deep shadows of the bromide image lay are completely tanned through, can therefore take up no water, and remain matt and sunken. This graded swelling of the gelatine film becomes more apparent, the higher the temperature of the water in which the film is swollen.

If, however, the paper was strongly tanned in the process of manufacture, the gelatine has already lost all or most of its swelling power before it is printed and, although the bleaching solution in such cases can indeed remove the silver image, it can no longer develop the differences of absorptive power which are necessary for a bromoil print; for, although the bleaching solution can harden an untanned gelatine layer, it cannot bring back the lost power of swelling to a film which is already hardened through and through.

Therefore bromide papers which have already been very thoroughly hardened in manufacture show no trace of relief after bleaching, and very slight, if any, shininess in the lights. This is the case especially with those white, smooth, matt, heavyweight papers which are especially used for postcard printing. When such papers are taken out of the solutions, as a rule, these run off quickly and leave an almost dry surface. It is generally not possible to make satisfactory bromoil prints on such

papers. It is true that the image can be inked by protracted labor; it is, however, muddy and flat and, as a rule, cannot be essentially improved even by the use of very warm water. Other types of bromide paper which have not been so thoroughly hardened may show no relief after bleaching, yet, after the surface water has been removed, they do show a certain small amount of shininess in the high lights when carefully inspected sidewise. With such papers the necessary differences of swelling can generally be developed if, as will later be more completely described, they are soaked in very warm water or in an ammoniacal solution. It is rare to find in commerce silver bromide papers which have not been hardened at all, or only very slightly hardened, in their manufacture. Such papers, because their films are very susceptible to mechanical injury, are not likely to stand the wear and tear of the various baths. On the other hand, as a rule, they usually produce a strong relief even in cold water, and therefore tend to produce hard prints. The greatest adaptability for bromoil printing may be anticipated from bromide papers which are moderately hardened during manufacture.

To determine whether a given brand of bromide paper is suitable for bromoil work, an unexposed sheet of the paper should be dipped in water at a temperature of about 30° C. (86° F.) and the behavior of the gelatine film observed. If this swells up considerably and becomes slippery and shiny, the paper has the necessary swelling power and can be used with success.

On account of the great variety of bromide papers which are on the market, we have a very wide choice as regards the thickness and color of the paper and the structure of its surface. It may be remarked here that



papers of any desired surface, even rough and coarse grained papers, can be used for bromoil printing, as easily as papers with a smooth surface. The difficulties experienced with very rough surfaced papers in some other processes do not exist in bromoil. Because of the elasticity of its hairs, the brush carries the ink as easily into the hollows of the surface as to its high points.

The thickness of the paper is of no importance in bromoil printing, except that the handling of the thicker papers is easier, because they lie flatter during the work and distort less on drying; also, as a rule, thick papers are easier to ink.

*Gaslight papers* can also be used if their gelatine films satisfy the above mentioned requirements. Therefore we have the widest possible choice in the printing materials for bromoil.

A great number of bromide papers of different manufacturers are well suited for bromoil printing; it is, however, advisable to make a preliminary investigation as to the amount of hardening they have undergone, for it occasionally happens that different emulsions of the same brand show quite different grades of hardening, so that on one occasion it is possible to make bromoil prints on them without the least difficulty, while the same paper at another time may absolutely refuse to take the ink. On account of the great popularity of the bromoil process in recent years, it can be easily understood that some manufacturers might seek a wider sale for their products by claiming for them a special suitability for this process. It is therefore a wise precaution to previously test even those brands which are advertised as specially adapted for bromoil printing, and not to depend too much on such claims.



DEVELOPMENT. — The processes of tanning in the film of a bromide print, produced by the bleaching of the silver image, which will be described later, are of an extremely subtle nature. We must therefore endeavor to avoid all causes for damage in this process and especially everything which tends to harden the whole film even to the slightest degree. Any tanning, which affects the whole gelatine film, has the same effect as general fog in a negative. It is well known that almost all the developers used in photography have more or less tendency to harden the gelatine film. A very considerable damage to the bromoil print through the use of a tanning developer might naturally be imperceptible to the eye. Yet this may at times manifest itself in a very undesirable and disturbing form, especially when the bromide paper has been so much hardened in manufacture that it possesses only just the necessary qualification for bromoil printing. It may then happen that the last remainder of swelling capacity can be taken from the paper by the use of a tanning developer. However desirable it might be and however it might simplify the process to be able to use any desired developer in producing the bromide print, to avoid trouble it must be observed that the use of developers which tan the film may seriously influence the result, even though it is possible to get some kind of prints in many cases. *If the worker is absolutely sure that the bromide paper which he is using is not strongly hardened and is therefore well suited for bromoil printing, he may undertake development with any one of the ordinary developers which he prefers.*

The developers, which do not exercise a hardening influence on the gelatine, are the iron developer and

amidol (diamidophenol hydrochloride). As the iron developer is not really suited to this purpose on account of certain unpleasant qualities inherent in it, it is advisable to use amidol for the development of bromide paper for bromoil printing whenever possible, and the best developer is composed as follows:

Amidol .....	1.7 g	12.3 gr.
Sodium sulphite, dry..	10 g	77 gr.
Water .....	1000 ccm	16 oz.

The sodium sulphite is first dissolved in water, and the easiest way is to pour the necessary quantity of water into a developing dish and sprinkle the pulverized or granular dry sodium sulphite into it while the dish is constantly rocked; solution takes place almost instantly under these conditions. Larger lumps, which would stick to the bottom of the dish, must be immediately stirred up. As soon as the sodium sulphite is dissolved, the amidol should be added and this will also dissolve immediately. The addition should be made in the order described, for, if the amidol is dissolved first, the solution is often turbid. If dry sodium sulphite is not available, double the quantity of crystallized sulphite may be used.

The amidol developer should be freshly prepared each time that it is used, as it does not keep in solution. The measurement of the quantities of amidol and sulphite given above does not need to be made with the most painstaking care, as small variations in the quantities are unimportant.

In using amidol developer the greatest care must be taken to avoid allowing amidol powder, in even the

smallest quantity, to come into contact with the bleached print ready for bromoil printing. Even the finest particles of amidol, although invisible to the naked eye, will produce yellowish brown spots on the gelatine which penetrate through the film and into the paper itself. These dots and spots, especially if, as is usual, they occur in large numbers, will make the print completely useless, and it is impossible to remove them.

If amidol developer is not available, *any other developer which is desired* may be used. As we have already stated, however, certain possibilities of failure are to be anticipated, but will not necessarily occur.

*Every effort should be made to produce a bromide print as perfect as possible, with clean high lights.*

The best bromide prints or enlargements for bromoil printing are those which are *correctly exposed, but are not developed out to the greatest possible density*. A print which is thus fully developed is very satisfactory as a bromide but offers certain difficulties in bromoil printing, which will be described later. *Therefore the development should be stopped as soon as the lights show full detail without any fog, but before the shadows have reached full density*. The deepest shadows should then be of a deep greyish black, but should not be clogged up. When a bromide print is properly exposed, there is sufficient time between the appearance of the details in the lights and the attainment of the deepest possible black in the shadows to easily select the proper moment for cessation of development. It is, however, desirable not to go beyond this stage of development, for the reason that *a very dense silver deposit distributed completely through the gelatine emulsion to the paper support is not easily bleached out*. When this difficulty



occurs, the bleaching solution is generally, but incorrectly, blamed for it. If, in spite of this difficulty, complete bleaching is attained, the shadows of the image usually retain a yellowish color which cannot be removed by the baths which follow the bleaching. If it is intended to ink up the whole surface of such a print, this discoloration of the shadows is not important, for it will be completely covered by the ink. But if the print is to be treated in a sketchy manner, and some parts of its surface are not to be inked, this cannot be successfully done on account of the yellowish coloring of the shadows.

*Underexposure* must be carefully avoided, for details which are not present in the bromide print will, of course, not appear in the bromoil print.

*Overexposure* will occasionally give usable results, if the development of the overexposed print is stopped at the proper point. In such cases, we must usually expect some deposit in the high lights and consequently a certain fogging of the image, though this can often be overcome, at least partly, by swelling the print at a higher temperature. Perfect prints cannot be expected, if the basic print is lacking in quality. If the overexposure is not too great, the print can be improved to a certain extent by clearing it in very dilute Farmer's reducer. Treatment with this reducer has no deleterious effect on the later processes. The Farmer's reducer should only be used for a slight clearing up of too dark parts of the bromide print; for this purpose the parts of the moist print which are to be reduced should be gone over with a brush dipped in very dilute reducer and immediately plunged into plenty of water, to avoid any spreading of the reducer into other parts of the image.

*Developing fog* should naturally be avoided as much as possible. Fogging of the bromide print is caused by the formation of a more or less dense silver precipitate without any relation to the image over the whole surface of the print. As the bleacher takes effect wherever metallic silver is present in the film, the result in such cases is a general tanning of the film, which is detrimental to the production of the necessary differences in swelling power in the gelatine. The tanned gelatine image is then also fogged.

*Consequently the best results may be obtained from very brilliant, but not excessively developed, bromide prints.*

We must also *avoid falling into the opposite extreme in the development of the bromide print, by getting too thin prints lacking in contrast.* In prints which are too thin, only a very small quantity of metallic silver has been reduced in the development, and this lies wholly on the surface of the film. Such prints usually show full detail, but the contrasts between the lights and the shadows are too small. Since the tanning produced by the later bleaching occurs because of the presence of metallic silver in the film, and since its intensity depends on the quantity of this silver, we cannot obtain the necessary difference in swelling power by bleaching the film of prints which are too thin because of insufficient development. The result is a weak tanned image in the gelatine film; bromoil prints thus produced can consequently only exhibit a very short scale of tone values, and this cannot be essentially lengthened by the use of the bromoil process alone. Such bromide prints may find a special application in combination transfers, which will be described later. It is also pos-

sible, under certain circumstances, to use incomplete development as a method for producing soft bromoil prints from contrasty negatives.

CONTROL OF THE SILVER BROMIDE PRINT. — Although in bromoil printing the most various renderings can be obtained from a perfect bromide print, by variation of the temperature of swelling and by proper handling of the inking, it is also possible, under some circumstances, to vary the final result by proper treatment during the making of the bromide print, especially when we are not dealing with normal negatives. If, for instance, we have to deal with a very thin negative, it is possible that even the extreme possibilities offered by the bromoil process are not sufficient to insure the attainment of the desired modulation, for, as will later appear, the possibility of increasing the difference in swelling in the film is limited by the limited resisting power of the gelatine. In such cases, we must take advantage of the accumulation of all possible aids and therefore, in making the bromide print, do all that is possible in order to bring out desired objects, which are only indicated in the negative and do not show sufficient detail.

*Therefore, if we desire to increase the contrast of the negative in the final print, we should use a harder working paper and add potassium bromide to the developer.*

*If we desire to get soft prints from a contrasty negative, we may use different methods. The simplest way is the use of a very rapid and consequently soft working paper. Ordinarily, however, this method is not sufficiently helpful. We must therefore also use suitable methods in later steps of the process, such as making the difference in swelling in the gelatine layer as small*



as possible in order to bring down the contrast, or inking up with soft inks.

A very reliable process for the production of soft prints or enlargements, even from contrasty negatives, is the following: the proper exposure for the densest portions of the negative should be first determined by means of a trial strip; then a full sized sheet of paper is exposed for exactly the time which has been determined, soaked in water until it is perfectly limp, and then placed in the developer. As soon as the first outlines of the image appear, the print is placed in a dish of pure water and allowed to lie there, film down. As soon as development has ceased, the print is taken out of water, dipped into the developer for an instant, and then immediately put back into the water. This method requires considerable time for full development, but produces prints or enlargements of especial softness. In this process, the developer which is absorbed by the film is soon exhausted in reducing the heavy deposit in the shadows, so that their development ceases, while enough developer still remains unexhausted in the other portions of the image to keep on developing. With very dense negatives, developer warmed to  $25^{\circ}$  C. ( $77^{\circ}$  F.) can be used for the production of soft prints, but it must be very much diluted and carefully used, for development proceeds very quickly. Very soft prints may also be obtained by bathing the exposed bromide prints for about two minutes in a one per cent solution of potassium bichromate before development. This solution is thoroughly washed out of the print, and it is then developed.

Yet with very hard negatives all these remedies frequently fail, because the high lights are almost com-

pletely opaque to light because of their density. In such cases the negative itself must be improved. The ammonium persulphate reducer usually recommended for such plates, which acts more strongly on the lights than on the shadows, is, however, too uncertain in its action and may imperil the negative. It is better to adopt *Eder's chlorizing method*, which enables one to improve too contrasty negatives in a convenient and certain manner. The principle of this process is as follows: the metallic silver of the negative is converted into silver chloride, which is again developed. This redevelopment is accomplished in such a way that the silver chloride on the surface of the film is first reduced to metallic silver; if development is continued, the reduction is continued to the bottom of the film. The delicate details, lying on the surface of the film, are thus first developed, while development of the overdense high lights, in which the silver deposit extends right through to the glass, is finished only after some time. It is therefore possible to stop development at the instant at which the shadows and half-tones are completely redeveloped, while the overdense high lights are, for instance, only half developed, and therefore only half consist of metallic silver, the lower half being still silver chloride. If the development is interrupted at this stage and the negative placed in a fixing bath, the still undeveloped silver chloride is dissolved. The shadows and half-tones thus retain their original values, and only the overdense deposits in the shadows are reduced. If the development is not stopped at this stage, but is carried through to completion, the negative is obtained unaltered, and the process can be repeated. If the second development is stopped too soon, the



negative may be endangered and a very thin negative, lacking in contrasts, obtained.

The practical application of the chlorizing process is effected by bleaching the negative in the following solution:

Cupric sulphate ..	100 g	1 oz.
Common salt ....	200 g	2 oz.
Water .....	1000 ccm	10 oz.

As soon as the negative is completely bleached, which should be judged not only by transmitted light but also by examination from the glass side, it should be well washed and immersed in a slow-acting developer. All these processes can be carried out in daylight, and the second development of the negative is best controlled by frequent examination of the glass side. Development should be stopped when the shadows and half-tones are blackened, and there is still a whitish film of silver chloride in the high lights. Observation of the negative by looking through it is not advisable, for the negative very soon appears dense by transmitted light, because the metallic silver formed in development masks the silver chloride. As soon as the development is considered to have gone far enough, the plate should be rinsed and then fixed and washed in the usual manner. After a few trials, the judgment of the correct stage at which to stop development presents no difficulty.

I ordinarily use the chlorizing process in the following way, which practically excludes any possibility of failure: the negative is completely bleached in the solution just mentioned, and then washed for five minutes. It is then developed in any desired developer until it shows by transmitted light practically the same

density, though in a brownish color, as it had before chlorizing. It is then rinsed off, placed in a solution of hypo, *not stronger than two per cent*, and carefully watched by light passing through the plate; it is taken out as soon as the desired stage is reached, well washed, and dried. In this modification of the chlorizing process the condition of the plate can be observed at every stage. The final negative, to be sure, does not consist of pure metallic silver, but as a rule of a combination of silver and silver chloride; but such negatives are sufficiently permanent for making prints and enlargements on bromide paper.

It is also advisable to lessen the harsh contrasts in a normal negative, either by masking the more transparent parts on the glass side, or by holding them back in printing or enlarging. Briefly, every possible means should be employed in order to obtain as good and harmonious a bromide print as possible.

*The beginner is strongly recommended, however, in his first trials with bromoil, to start as far as possible with normal negatives and correct, and especially very clean, bromide prints.* The use of this process for the improvement of the results from difficult negatives should be left for more expert workers.

It is often desired to provide landscapes with clouds, and this can be easily attained if enlargements are used as the basis for bromoil prints. Acceptable results are given by a process, which has often been recommended. This is, after blocking out the sky on the negative, to enlarge the landscape, develop the print and again place it while still wet on the enlarging screen and expose for the clouds, disregarding the existing image, and then develop the clouds.

I might describe here another process for obtaining clouds, because it is especially suitable for the bromoil process. If there is no object in the negative which is cut by the upper edge of the plate, it is extremely easy to introduce clouds into such a landscape, and at the same time lengthen out the picture at the top. A cloud negative suitable for the landscape is chosen, and the relative exposures for the landscape and clouds found as accurately as possible by test strips. The landscape negative is then focused on the enlarging screen so that there is plenty of paper above the upper edge of the plate, and then the exposure is made while the upper part of the paper is covered with a card, which is kept moving constantly between the light source and the enlarging screen, so that the upper edge of the plate is not imaged on the screen. After the exposure is finished, the paper is shifted down on the screen until the upper edge of the paper comes at the place which was previously occupied by the edge of the plate, the landscape negative is changed for the cloud negative, and the clouds are exposed on the upper and hitherto unexposed part of the enlarging paper, while the landscape is protected from exposure by means of a piece of card, shaped like the previous one for the sky, and continually moved to avoid a sharp line of separation. In the subsequent development a perfectly uniform picture is obtained, in which there should be no visible trace of its compound nature.

Obviously, in the preparation of the bromoil print, it is advisable to employ to the utmost the many possibilities which bromide printing offers. Thus too thin parts of a negative may be held back by proper blocking out on the back and numerous other possible modi-



fications, which have been described in textbooks and technical journals, but which cannot be further dealt with here, may be profitably employed.

FIXATION. — *The developed bromide print should be well rinsed and fixed in the usual way.* If the rinsing is omitted or is too superficial, complete or partial reduction phenomena may occur in the fixing bath, and make the print unusable.

The bromide print should be left in the hypo solution for about 10 minutes, and care should be taken, if several prints are simultaneously treated, that they do not stick to one another. Then should follow thorough washing for removal of the hypo; if traces of hypo remain in the film, the subsequent bleaching is rendered more difficult, as the image does not disappear but only turns brownish. While it is feasible to subject the bromide print to the bleaching process, as soon as it comes from the washing, *an intermediate drying is an advantage*; for the gelatine gains greater resistance by this drying.



## CHAPTER II

### THE REMOVAL OF THE SILVER IMAGE

**B**LEACHING. — The bleaching process has the purpose of making the bromide print, correctly prepared according to the previously described method, suitable for the bromoil process. To this end the silver image must be made to disappear and in its place that condition of the gelatine produced which renders it possible for it to take up the greasy ink. *The bleaching solution has, therefore, two functions: it must remove the metallic silver, imbedded in the gelatine film, which forms the bromide image, and at the same time cause a tanning of the gelatine film corresponding to the image that disappears. In the place of the silver image there then exists an invisible tanned image in the gelatine film.*

There are a large number of chemical compounds known to photographic technique, which enable us to dissolve out the metallic silver imbedded in the gelatine film. Such are, for example, the many reducers which have found practical application. Many of these chemicals also cause changes in the gelatine simultaneously with the solution of the silver. But not one of the hitherto known bleaching solutions possesses the double power required of it: solution of the silver image and corresponding tanning of the film. Some produce too great a tanning which acts upon the whole film, and the result in inking-up is muddy flat prints, which do not lend themselves to artistic modification. With other

bleaching solutions a differential tanning of the gelatine is produced, but at the same time they so alter the surface of the gelatine that it becomes glossy all over, and only takes even soft inks with difficulty.

My experiments have led to the compounding of a bleach which completely fulfils the requirements set for it; the silver image is quickly and completely removed, while simultaneously a tanning of the film, strictly analogous to the disappearing image, is effected; easier and more certain inking-up is rendered possible, and besides this the advantage is obtained that the differences of relief, produced in the gelatine by the bleaching process, can be influenced to a wide degree by varying the temperature of the water. The composition of this bleaching solution, which prepares the gelatine film in the most perfect manner for the bromoil print, is as follows, three stock solutions being required:

I. Cupric sulphate . . . .	200 g	2 oz.
Water . . . . .	1000 ccm	10 oz.
II. Potassium bromide . .	200 g	2 oz.
Water . . . . .	1000 ccm	10 oz.
III. Cold saturated solution of potassium bichromate.		

A concentrated bleach is made by mixing:

Solution I.	3 parts
Solution II.	3 parts
Solution III.	1 part

To every 100 ccm of this mixture should be added 10 drops of pure hydrochloric acid (10 drops to  $3\frac{1}{2}$  oz.). This concentrated bleach will keep indefinitely and

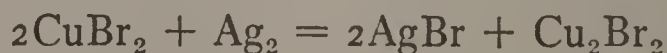
should be diluted before use with three to four times its volume of water. The use of a more concentrated solution is not advisable, as irregularities frequently occur in consequence of too rapid bleaching, especially towards the margins of the prints.

The color of the concentrated bleach is green, or when diluted, yellowish; the solution must be absolutely clear. When the stock solutions are mixed there is usually some cloudiness, but this is cleared up by the hydrochloric acid. By standing for a long time at low temperatures a precipitate is sometimes formed, but this is of no moment. The compounding of this bleach should be made with the greatest accuracy. Inaccuracies or modifications in its composition are serious, because although the solution does not lose in bleaching power, yet the invisible tanning action is then often not completed in the desired manner. Too great an addition of hydrochloric acid for example, accelerates the process of bleaching, but the inking-up of prints thus bleached is frequently difficult. If the bleaching of the shadows of the bromide prints goes on slowly, the reason as a rule lies in the fact that the prints were overdeveloped and have an excessively dense silver deposit.

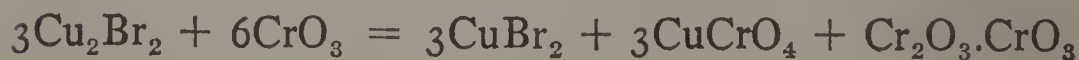
The bromide prints should be immersed in this bleaching solution, after previous soaking in cold water. If they have been correctly made, the image rapidly grows weaker and after a few minutes its greyish-black color changes into a pale citron yellow. If the bromide print was developed too far, the bleaching takes rather longer, as the shadows, developed right through to the base, require a lengthy period for solution. If several prints are to be bleached at once, the best procedure is to place one print in the solution and turn it film side

down when the first traces of bleaching are noticeable. Then the next print should be immersed with the film up and by thus proceeding gradually it is possible to bleach a large number of sheets simultaneously in the one dish. Continual movement will prevent the formation of air bells. If air bells adhere to the film, they protect those places from the action of the bleach and dark points or spots of unchanged metallic silver remain, the subsequent bleaching of which naturally prolongs the process. The same applies to prints which lie on top of one another.

With too slow bleaching, the hydrochloric acid may be gradually increased, *at the most* to double that prescribed; one should not hasten the bleaching process by warming the solution. The bleaching is rapidly effected in warm solutions; yet generally the film of moderately hardened papers is so altered that they swell up too much even in cold water and take the ink badly or not at all. The dilute bleaching solution will keep and may be used repeatedly as long as it acts; when it becomes exhausted, the slowing up of the bleaching cannot be hastened by the addition of hydrochloric acid. The chemical reactions in the bleaching bath are, according to Dr. P. R. von Schrott, as follows:



The cuprous bromide,  $\text{Cu}_2\text{Br}_2$ , which is formed, reduces the bichromate as follows:



*It sometimes happens that bromide prints, in spite of*



*long immersion in the bleaching solution, apparently will not bleach and only change their color to brown.*

The reason for this usually unimportant phenomenon is, as a rule, that such prints have not been sufficiently washed and still contain hypo.

It may also happen that prints which have lain on top of each other in washing are badly washed in parts; then the image bleaches, *but the film shows dark patches or streaks at those places which still contain hypo.* Such apparently unbleached prints should be left for about 10 minutes in the bleaching solution; *the disturbing coloration, whether of the whole picture or only of parts, disappears completely in the subsequent baths,* even when the image had apparently remained at full strength.

If such a print, apparently not bleached or spotty, is immersed in the sulphuric acid bath mentioned below, the discoloration of the film is quickly removed by its action; the print then often passes through a phase in which it appears to be a negative, the secondary image becoming visible on the yellow ground, and then bleaches out completely. With such prints it may also happen that it is only noticed after removal of the stain that unbleached traces of the silver image still remain. Then the bleaching must be repeated.

If the color of the bromide print only changes to brown even after protracted immersion in the bleaching solution, otherwise retaining full gradation, and remaining unchanged even in the sulphuric acid bath, though it bleaches out in the hypo, the print cannot be inked. The reason for this difficulty is improper composition of the bleaching solution, or occasionally improper development and fixation of the bromide print. It may

also be due to excessive use of the bleaching solution; 3 to 4 ccm (50 to 70 minims) of concentrated bleaching solution should be allowed for every 13 by 18 cm (5 by 7) print.

Obviously all these processes may be carried out by diffused daylight. The bleached-out prints should be repeatedly washed, until the drainings are quite clear, and should then be immersed in the following bath:

Sulphuric acid, pure . . . . .	10 ccm	77 min.
Water . . . . .	1000 ccm	16 oz.

*In this bath any remaining color disappears quickly and completely, and prints, which have apparently wholly or partially resisted bleaching, are also very rapidly decolorized in this bath. Any spots and streaks also disappear. If, however, there is anything left, then the bleaching was not complete, and unreduced metallic silver remains in the film. After the sulphuric acid bath the prints should show the pure color of the paper base; the film side ought to be hardly different from the back in color. With prints that have been over-developed, a certain slight variation of color remains in the film, which, however, in no wise prejudices the inking-up. If there are still some spots, they are usually due to a slight precipitate lying on the surface of the film, which can be easily swabbed off. When this point of colorlessness is reached, and it usually requires only a few minutes, it is useless to leave the prints longer in the acid bath. They should be washed in repeated changes of water and immersed in the following fixing bath:*

## REMOVAL OF THE SILVER IMAGE 35

Hypo	.....	100 g	1 oz.
Water	.....	1000 ccm	10 oz.

The use of this fixing bath is essential and is based on the following considerations. During the bleaching process a secondary silver bromide image is formed in the gelatine film. This secondary image is not visible on white and yellowish bromide papers, because it is whitish-grey. If a bleached print, which has not been fixed, is exposed for a long time to daylight a distinctly visible blue-grey image is formed, which naturally is troublesome in the further operations. This secondary image of silver bromide is completely removed, however, by the fixing bath.

The ordinary acid fixing baths can also be used without disadvantage for fixing. If the sulphuric acid is not sufficiently washed out, decomposition of the fixing bath may ensue, which will be made apparent by the unpleasant smell, and which is prejudicial to the action of the bath. Care should be taken that the prints do not stick to one another in the fixing bath and that they are thoroughly fixed out, as the secondary bromide image that is not removed will make its appearance in insufficiently fixed places and may cause darker patches.

Washing then completes the preliminary preparation of the prints.

For the sake of completeness it should be mentioned that the prints may be immersed in the bleaching solution in the darkroom after the first development, and can be fixed after the solution of the silver image. This shortened process is, however, uncertain and can not be recommended.



THE INTERMEDIATE DRYING. — *After the bleaching process outlined in the previous section the print must be dried without fail.* While drying after the development and fixation of the bromide print is advisable but not absolutely necessary, *the intermediate drying after bleaching is of the greatest importance.* It is possible that the later operations may be successful in spite of neglect of this recommendation. As a rule, however, various mishaps occur when the intermediate drying is omitted. In many cases the ink can only be caused to adhere with difficulty, in others, not at all; sometimes the inking will proceed up to a certain point and then suddenly completely stop. Sometimes the image appears as a negative, that is to say, the ink is taken up by the high lights and rejected by the shadows. All these failures will be obviated by the intermediate drying at this stage. Whether this intermediate drying takes place rapidly or slowly is practically immaterial; naturally it ought not to be so prolonged that the gelatine suffers.

The prints thus prepared can either be again soaked in water and immediately worked up, *or kept and treated at any time.* It is very convenient, especially for an amateur, to have a stock of such ready prepared and dry prints, because he is then in a position to work when he finds time and opportunity. The prints, prepared and dried as has been described, will keep indefinitely. With correct treatment there can be seen on the gelatine film of the dry print scarcely a trace of the bleached-out image; only in the very deepest shadows a slight coloration of the film, tending to grey, can sometimes be noticed. It is advisable, therefore, to mark the print on the paper side before bleaching, as otherwise it is subsequently difficult to distinguish this.



Before we go any further, the whole preliminary process is summarized once more:

Development,  
Fixation,  
Washing,  
Bleaching,  
Short washing,  
Sulphuric acid bath,  
Short washing,  
Fixation,  
Washing,  
Intermediate drying.

### CHAPTER III

#### THE INKING-UP

**T**HE PRODUCTION OF THE DIFFERENTIAL SWELLING. — In the chapter on the bleaching we fully explained the processes which take place in the gelatine film under the action of the bleaching solution, and that the most important result of the bleaching process, aside from the disappearance of the silver image, is the formation of different degrees of swelling corresponding to the primary image, which in their totality form the tanned image produced in place of the photochemical image by the bleaching.

*For the success of the bromoil print, it is now of the utmost importance that the different capabilities of swelling, now latent in the gelatine film, should be satisfactorily utilized. It is obviously possible to produce this swelling in very different degrees. The colder the water used for the swelling, the smaller the difference between the lights and shadows, while the warmer the water the more this difference is accentuated. If, for example, a print prepared for the bromoil process is placed in cold water and allowed to swell for some minutes, the existing capacity for swelling will only be excited to a slight degree. The high lights of the invisible image only take up a little water, and when dry are differentiated from the shadows under oblique visual examination by a very delicate gloss or not at all. If*

this picture is now worked-up with greasy ink, a print is obtained with *a short scale of gradation, and its tone values are usually less satisfactory than those of the original bromide print*. If, on the other hand, the print is placed in *very warm water*, the swelling of the gelatine reaches a maximum. The high lights are very much swollen, even the half-tones are somewhat raised, and the shadows, which do not absorb water, appear sunken. The result of the swelling in such warm water in this case is the formation of a very pronounced relief, that is not only visible, but is almost perceptible to the touch. If such a picture is inked up, a bromoil print is obtained, *the contrasts of which are much stronger than those of the original bromide print*. Between these two extremes there is obviously a whole series of intermediate stages, the suitable employment of which permits of the most varied gradations.

As already mentioned, the capacity for swelling of the different makes of bromide papers is not the same in baths of the same temperature. This fact, however, argues neither for nor against the usefulness of the various bromide papers. It makes necessary, to be sure, a certain care in the use of a paper, the qualities of which are unknown. If one has to deal with such a paper, the prepared print should first be soaked in quite cold water; it should then be removed from the water, placed on a support, dried in the manner to be later described, and examined by oblique illumination as to whether the high lights show by a slight gloss that they have absorbed water. This will be the case if the image shows well swollen high lights; if they are not present, it will hardly be possible to find distinctly glossy places. In any case one may begin with the inking-up, prepared,

as will be explained later, to increase the swelling if necessary during the inking-up by immersion in warm water. If on the other hand, the print, when taken from the cold water, distinctly shows places where differences of swelling are shown by a gloss or even a delicate relief in the film, the work may be proceeded with, without further trouble.

Under any circumstance one should be careful at first in the production of the differential swelling. *There should rather be no relief than too pronounced a one;* for differences of swelling that are too small can be easily and satisfactorily increased during the work; on the other hand it is scarcely possible again to reduce too strong a relief. While learning, or when using an unfamiliar brand of paper, it is therefore advisable to allow the sheet to swell first in cold water and to carefully begin the inking-up. Only if this is not satisfactory, should a warmer bath be used and the inking again tried. This method is, however, dealt with more fully in the section of Chapter III, entitled "Different Methods of Working" (page 85).

THE PROPERTIES OF THE RELIEF AND ITS INFLUENCE ON THE CHARACTER OF THE PICTURE.—In order that the following explanations may be understood, an important property of the prepared and dried gelatine film must be mentioned.

The film of the prepared print, in which the differences of swelling necessary for the formation of the bromoil print are latent, develops variations of relief when it is placed in water. Then the untanned high lights absorb water, as already described, while the hardened shadows do not absorb it. The result of this process is the formation of those swellings, which, when they



have attained a certain degree, are characterized by the formation of a relief.

A definite degree of swelling corresponds to a definite temperature of water. This swelling disappears again if the film is dried. *The gelatine has, however, acquired the property of again attaining the same degree of swelling when immersed in water at any time after drying, even if the temperature of this water be a good deal lower.* A print, for example, on which a certain relief has been produced in water at  $35^{\circ}$  C. ( $95^{\circ}$  F.) and which has given up this water again because of drying, again attains the same relief if immersed in ordinary tap water at  $10^{\circ}$  C. ( $50^{\circ}$  F.). If, however, this print after drying is immersed in water at  $40^{\circ}$  C. ( $104^{\circ}$  F.), that is in hotter water than that first used, a still higher relief is obtained, and again in a similar manner, after drying, it will attain this higher relief when immersed in water at any lower temperature.

*The degree of swelling that is once attained can, therefore, so far as the resistance of the gelatine film will permit, be increased, but it cannot be reduced, if the print as a whole is not subjected to a tanning, as with formaldehyde, a process that is not easily controllable.* This peculiarity of gelatine makes it necessary to go to work carefully in the formation of the relief, so as not to carry the latter too far. If the work is begun on a too low relief this can be easily increased to the necessary height, as will be shown later, absolutely without any regard to any inking up that may have been done. *On the other hand, if the formation of the relief has once been carried too far, as a rule the print can not be used, although reduction of the excessive swelling by a tanning agent may be attempted.*

The property of the gelatine film, just described, offers a further convenience for the bromoil worker; for he can bring the bleached and dried print to the necessary degree of relief in water of suitable temperature, and, if he does not wish to work it up at once, it can be dried and laid aside until needed. In working-up such prints he is then, as a rule, relieved of the necessity of obtaining warm water.

*The question how far the swelling of the film has to go or in other words what kind of a relief should exist, if any,* in order to obtain a harmoniously graduated bromoil print, is extremely difficult to answer. A few practical trials quickly give the ability to judge this correctly. If a well-modulated negative is used, one in which the differences of gradation between the high lights and the shadows are not too great, the swollen gelatine film after drying should show a very delicate but still noticeable relief; yet the high lights of the print should scarcely be raised above the shadows, and should not show too marked a gloss.

The visibility of the relief is essentially determined by the character of the print. The more contrasty the bromide print was, the more easily are the different degrees of swelling made apparent by the formation of a visible relief. A picture with sharp outlines and great contrasts, such as an architectural study, easily gives a distinct relief visible in all its details. Pictures with softer gradation, as, for instance, delicate portraits, behave differently. One can not expect a striking relief in such prints. If this should be forced by warming the water, the bromoil print may easily attain an undesirable harshness. With portraits, one should therefore be satisfied when the outline of the profile against

the background, the contours of the eyes and the mouth, are raised to a barely visible extent from the gelatine base. At the same time very dense parts, like a white collar, a lady's light dress, lace, etc., may show a very distinct relief, even when the sharper lines of the face scarcely stand out in relief. Yet even in such cases the features can be recognized by the different gloss of the high lights and shadows under oblique observation. Naturally some attention must be paid here to the particular views of the operator. If strong contrasts are desired, greater differences of swelling must be used; if, on the other hand, softly modulated effects are sought, distinct relief must be avoided. In any case it is advisable not to attain this at once, but to get it as needed during the working-up by the use of water gradually increasing in temperature.

*It must be laid down as an axiom that the efficiency of a relief should never be judged by the eye alone, but should always be carefully tested out by inking-up with the brush.* The degree of swelling is correctly estimated at the first attempt when, in inking-up, the picture appears quite clearly after a little hopping, and this may happen if the character of the image is right, even though no relief could be seen.

*The stronger the relief formed by warming the water, the more contrasty the bromoil print will be.* Nevertheless there is a certain limit which should not be overstepped. If the print is warmed in the water bath so much that an excessive relief, which can almost be felt with the finger, is formed, in which deeply cut lines alternate with highly glazed places in relief, then the high lights are so saturated with water that under no circumstances will they take ink; even the softest inks



will not adhere to them. Thus we obtain harsh highlights without details, while the deeply sunken shadows literally fill up with ink and become sooty. If the formation of the relief has been driven so far, it is not advisable to treat the print with ink.

The forcing of the relief to the extreme possible limit is only justified when working with a flat negative, in order to obtain as rich a gradation as possible from a flat print. Also, this should not be done all at once before the commencement of the inking-up, but effected gradually during the work. Working in this way, extraordinarily successful results can be obtained and the contrast of the bromoil print can be made far more rich than that of the original bromide print. The limit lies only in the resisting power of the gelatine film and the flatter the bromide print was the sooner this is reached.

The upper limit of temperature permissible for the water can hardly be defined; it depends entirely on the hardness of the gelatine film. It may happen that it is necessary gradually to go almost to the boiling point. Films that are hardened right through will withstand even boiling water without forming a relief.

If, in warming the print, the melting point of the gelatine is approached, those parts which are but slightly tanned, such as the high lights, and especially any unexposed edges, begin to show a granular structure, and finally, when the heating is carried further, to melt.

*In the development of the relief great care should be taken that no part of the print remains dry, and, if the film is placed face down, air bubbles should be avoided. If the print is placed face up in the dish, no part of it should project above the water, as it will then not ab-*



sorb enough water; if the swelling has already taken place and a part of the film projects above the water (and this frequently happens, as the print, which at first lies on the bottom of the dish, after some time rises to the surface), the relief of the exposed parts goes down after some time, since the water evaporates from them into the air. Such insufficiently swollen parts, or those which have dried out, behave exactly as though they had been tanned more than the other parts of the surface. They have been able to absorb little or no water, or have lost the absorbed water by evaporation. They therefore take the ink, like the tanned shadows, far more readily than they would if they had retained the right amount of water, and far more ink adheres to them than should be the case and than adheres to the correctly swollen parts of the film. Thus patches of different form and size are formed at these places by the stronger adherence of the ink. Yet by renewed soaking of the print in the water these neglected places may be easily brought anew to the correct degree of swelling, and as far as concerns small spots caused by air bells, can be easily corrected. If larger patches of the film are insufficiently swollen, after the application of the ink they are usually much darker than the rest of the surface, and in such cases it is not always easy to obtain again the necessary evenness of the ink; it is then often necessary to ink up the whole print much more strongly than was originally planned, or to remove the whole film of ink.

Besides the warm water bath there is also another means at our command to produce the differences of swelling. This is the use of *ammonia*. A. & L. Lumière and Seyewetz, in a treatise published in 1913, on the

resistance of gelatine to alkalis, found that cold solutions of ammonia did not attack gelatine but caused it to swell more.

If a bleached print is immersed in an aqueous one per cent solution of ammonia, the film attains in a very short time *the highest degree of swelling of which it is capable*, without the gelatine in the high lights being softened or damaged. The estimation of the height of the relief, which is so important for the successful carrying out of the inking, is scarcely possible with the ammonia bath, as it is extremely difficult to gauge its action. Therefore, it should only be used in those cases in which the highest swelling is absolutely necessary, as for instance, when using papers which have been strongly hardened in the manufacture, or with prints with very poor contrasts. A further application is with the transfer process, in which on the one hand it permits of the use of very soft inks and on the other hand enables one to keep the gelatine very resistant. Full details on the transfer of bromoil prints will be found in a later chapter. In very extreme cases, one may try to combine the action of the warm water and the ammonia bath, and use a warm ammonia bath. The  $\frac{1}{2}$  to 3 per cent solution of sodium carbonate recommended by E. Guttmann acts even more energetically than the ammonia solution.

As is obvious from the foregoing remarks, it will be as well to work usually with water baths and leave the ammonia bath for a last resource, the more so as in the swelling of prints in this bath certain troublesome phenomena may appear, which do not occur when using the water baths. Sometimes the bleached image reappears in the ammonia bath in a brown color; some-

times small white spots appear on the prints which will not take the ink and which, as can be determined by examining them by transmitted light, also exist in the substance of the paper; finally the gelatine film sometimes swells all over, so that the ink is not taken up anywhere. Prints which are failures in consequence of the use of the ammonia bath, should be dried and can be again treated in a warm water bath.

THE UTENSILS. — For the application of the ink the following are required:

*Brushes.* — A best quality oil-printing brush with very elastic hairs cut on the slant, the so-called stag's-foot brush, should be used. To apply the ink, a brush should be used with a working surface of from  $1\frac{1}{2}$  to  $2\frac{1}{2}$  cm ( $\frac{5}{8}$  to  $1\frac{1}{4}$  in.) diameter; by diameter is meant the length of the longer axis of the elliptical surface produced by the slanting cut of the brush. For working-up very small surfaces or for placing accents of color, a brush of about  $\frac{1}{2}$  cm ( $\frac{3}{16}$  in.) measurement should be used. In certain cases still smaller brushes may be useful. Such brushes are only used for working up details; they are only aids for special work. For the application of the ink generally, only the larger brushes should be used. It is far more difficult to apply the ink evenly with small brushes than with the larger ones, so that their use may cause needless discouragement.

The application of the ink is effected by placing the whole working surface of the brush charged with ink on the print, and then slowly lifting it up; this results in a deposition of ink corresponding to the working surface of the brush used. The smaller the brush the more often it must be applied, and therefore, the greater the probability of irregular inking, especially in those



parts where the brush marks overlap. Also small brushes are handled less conveniently than larger ones and smear easily. The first thing to do in inking a bromoil is to obtain a good, even, thin film over the whole surface, to get a general impression of the whole effect. Only then is one in a position to judge how the tone values should be varied. The use of too small a brush unduly protracts this first operation and makes it difficult.

The brushes should be elastic but not too soft. Too soft brushes smear, that is to say, they deposit the ink in a thicker layer at their edges than in the middle and produce elliptical rings of ink, which must always be evened out by hopping.

In determining the size of the brush, the size of the bromoil print must be taken into account. Generally it is easier to work with brushes of from  $1\frac{1}{2}$  to  $2\frac{1}{2}$  cm ( $\frac{5}{8}$  to  $1\frac{1}{4}$  in.) in diameter. For large sizes up to 30 x 40 cm (12 x 16 in.) brushes of even 4 or 5 cm ( $1\frac{1}{2}$  or 2 in.) may be used. Such brushes are not cheap, but are practically indestructible, if they are properly cleaned every time after use. The brushes are sold in tubular paper cases; these latter should be preserved and the brushes, after cleaning, put back into them, so that they are covered and the hairs do not get ruffled.

In order to preserve the brushes and keep them in good working order, they must be cleaned as soon as the work is finished, otherwise the ink left in them sets and makes the hairs brittle.

Brushes of long swine bristles with cut ends may also be used; with these especially, clean prints are quickly attained. They are superior to hair brushes of poor grade.



*The cleaning of the brushes* is best effected as follows: Pour into a deep dish a *readily volatile* fat solvent, such as benzol, trichlorethylene, carbon tetrachloride (carbona), etc.; but not turpentine, for if this be used the brushes cannot be used sometimes for days. Dip the brush into the liquid and press out the solvent on the edges of the dish, and stroke the brush vigorously on a piece of lintless linen, which should be used for this purpose only. The solvent can be used, ignoring the opacity which it soon assumes, as long as it will dissolve the ink. Only the hairs of the brush should be dipped in the solvent, but not the binding, as in some cases the cement with which they are fastened may be attacked.

*The Inks.*—Theoretically, any ink prepared with a fatty medium is suitable for bromoil printing. In order to give satisfactory results, the inks must satisfy two conditions: they must have the correct consistency and their medium must be soluble in benzol. As regards the consistency of the ink it should be noted that the prepared film in its swollen condition, that is when the lights are saturated with water, absolutely repels greasy inks only when this swelling attains the highest possible degree; a case which one seldom needs and which will usually have to be avoided. If this swelling is not carried to the limit, the high lights, in spite of the water they hold, will take up the greasy ink, yet usually only when the ink is very soft. *The swollen high lights thus repel ink of thicker consistency, while they take the softer inks more easily in proportion as they become thinner.* That the tanned shadows also take hard ink is natural, for they do not contain, or contain only to a very small extent, the water which repels the ink.

From these considerations it follows that in many cases satisfactory results cannot be obtained by using ink of only one consistency.

*The hard or heavy ink* should have about the consistency of table butter, and it should be possible to spread it into an even smooth film on a glass plate with light pressure. *The soft or light ink* should have about the thickness of honey and should spread under the knife without noticeable pressure.

*Collotype or copper-plate printing inks* of various makes are frequently usable. As a rule, however, they must be tested as to their usefulness for our process; their consistency is frequently too hard, and sometimes they are not taken up by the film or cannot be distributed well, even when they are considerable diluted with linseed oil varnish, in spite of an apparently correct consistency.

The nature of the ink is not only influenced by the greasy substance used as a medium, but also by the material of the coloring matter itself. This is why many inks, in spite of their apparent softness, work tenaciously or "short," while sometimes inks of hard consistency smear.

If occasionally the dilution of an ink of too hard consistency appears necessary, this is best effected with linseed oil varnish, which, however, should not contain any driers. If the work has been begun with a stiff ink of a certain shade and it is desired to retain this tone to the end, it is advisable not to use a thin ink for dilution, but to thin down the stiff ink with varnish.

*Inks of too hard nature* are not practicable. Such were necessary in the oil-printing process. In the bromoil process, which is much less sensitive to the con-

sistency of the ink, their use merely means a needless loss of time. An ink of correct consistency is easily taken up and produces quick drawing without smearing, while too hard inks are difficult to apply and soon refuse to take if they are not diluted.

It is extremely simple and advantageous to prepare the inks oneself, as outlined by E. Guttman in Chapter VIII, p. 177. The process recommended by him is to place the powdered colors on a matt glass plate and rub up with varnish by means of a muller or pestle. This procedure is considerably facilitated, if, according to my suggestion, a few drops of a readily volatile oil-solvent be added. The ink is thus immediately liquefied and can be quickly and perfectly rubbed up. The solvent evaporates during the grinding, which is much easier than in the old way, and the ink again acquires the desired character without suffering in any way.

*As a palette for the ink* the best thing is a piece of waxed or parchment paper, fastened on a white support, such as a card. Such a palette has the advantage that after use it can be discarded without cleaning. Moreover the color value of the ink can be fairly easily determined on it. If necessary old negatives, or other glass, may be used as a palette, and their use also makes cleaning unnecessary, which is an unpleasant and messy job.

A small quantity of ink should be taken and distributed as thinly and evenly as possible on the palette. A thick layer is not convenient, as then the brush takes up too much ink and too much is deposited at a time on the bromoil print. The film of ink should show as smooth and uniform a surface as possible; thicker ridges should be avoided, because the brush is thus more



strongly inked in spots and therefore transfers the ink unevenly to the print. The distributed ink should be perfectly homogeneous and flexible. A thin layer of ink sets to a skin on its surface after a short time and then cannot be used.

This setting also takes place in the body of the ink and becomes evident by the formation of a delicate skin or hard crumbly particles on the surface of the ink. These must always be removed; such hardened inks can only with difficulty be distributed on the palette. Finally it should be mentioned that hard inks may be slightly softened by warming.

THE SUPPORT. — A stout glass plate or drawing board should be used as a support, and inclined at an angle of about 30 degrees by propping up at the top; *a damp and elastic pad* must be placed on the glass or board. *This pad is not for the purpose of keeping the print damp during the working-up, as is usually stated; on the one hand this is superfluous in view of the possibility of repeated soaking, which is to be described later, and on the other hand it would not produce the desired result. It is erroneous to suppose that the water which passes from the damp support to the paper side can equalize the loss of water which the film suffers by evaporation from its surface. The pad should, therefore, only be so damp that the bromoil print adheres firmly to it, when under the brush. The pad should absorb and hold moisture; but this should not be imparted to the brush when it touches the pad in working-up the edges, otherwise water will be carried on to the print and cause spots. For this reason damp blotting paper or filter papers should be absolutely rejected for the pad. If such papers are used for the*



damp pad, the brush, which in working the edges must inevitably touch them, will not only take up water but also the paper fibers and, transferring them to the print, cause trouble. Moreover, sheets of paper in a damp state are difficult to lay smooth and are scarcely usable.

The best material for the pad is the *copying sheets* used for copying books, which consist of two layers of linen with an intermediate film of rubber. Such sheets have the advantage that when damp they always remain flat and smooth. A damp piece of linen, doubled and smoothed out, is also simple and certain. The pad must lie absolutely flat, because any ridges become most unpleasantly visible in inking-up, particularly with thin papers, as the brush always slips from the highest parts of the ridges and causes inequalities in the print.

REMOVAL OF THE WATER FROM THE SURFACE OF THE PRINT. — After the prepared print is removed from the water and laid on the pad, the water adherent to its surface must be removed. This is best effected in the following way: Take a large, absorbent, lintless cloth, spread it smoothly over the print, and press it gently with the flat of the hand. By repeating this, the water is easily removed without endangering the film; whether the drying is complete can be judged by *examining it obliquely*. *The freedom of the cloth, used for drying the print, from fluff and lint is of great importance*. If the cloth gives up fibers to the surface of the print, these cannot be seen at first. In inking-up, innumerable minute dark spots and lines appear on the film, as the deposited fibers take the ink very strongly and thus suddenly become visible. It is frequently erroneously assumed that such troublesome defects come from the brush. This is seldom the case; on close examination

these fibers will be seen to be particles of the textile material. When possible, linen that has been frequently washed should be used for the drying.

When the water is to be removed from a print that has already been inked and again soaked, care should be taken that the cloth is freed from any folds by damping and subsequent drying, for such folds can, when pressed on the print, damage the film of ink. Although this is not of material importance, as such faults can be easily evened out by hopping, yet these small precautions avoid unnecessary trouble. Sidewise or wiping movements of the cloth should be carefully avoided, especially if the print has already been inked, because the ink is unnecessarily smeared by the wiping. After removal of the cloth one should make sure by examining the print obliquely that the water has been completely removed from the surface.

It is advisable to keep several cloths ready for drying off the film, for this will have to be done fairly frequently during the work. *Care should be taken to remove most carefully every trace of water; water which is picked up by the brush causes spots*, for the drops of water in the brush keep the ink away from the points of contact. In such cases it will be seen that white spots make their appearance in different parts of the print, continuously shifting their position during the work. By perfect drying off, these phenomena, which are in any case not necessarily important as regards the final result, can be avoided. In drying off a print already inked-up, the cloth will as a rule remove some ink from the surface; such cloths should not be used again until they have been washed, because they may transfer ink to a place where it is not wanted.

THE BRUSH WORK. — The prepared print, lying flat on the pad, and with its surface freed from adherent water, should now be inked up.

Before beginning the application of the ink a little stiff ink, at least as large as the working surface of the brush, should be placed in a corner of the palette. This should be spread out flat, thin and free from ridges; then the knife should be wiped and a little soft ink spread in another place.

The brush should now be pressed down on the *hard ink* already distributed on the glass plate, and the ink dabbed very carefully from the brush on a clean place of the palette. *One should never go with the brush direct from the ink itself to the print, as this will form a spot which it is difficult to work out. It is of the greatest importance always to work with a brush that has been well dabbed out and in which the ink is evenly distributed.* If the brush has not been sufficiently dabbed out it leaves on the print a quantity of small, much darker and usually linear particles of ink, which cannot be distributed or are only removable with difficulty. Such spots must then as a rule be removed by the method described on page 72.

The whole brush technique is based on the following principle: if the brush charged with ink is placed on the print and allowed to remain there for a moment, and then *slowly* lifted up, the ink remains on the image. If it is set down sharply and *quickly* lifted (the so-called "hopping"), it removes ink. In the first inking-up of a print, the swelling of which has been correctly carried out, the application of the ink may be effected by a gentle dabbing. A very thin film of ink is thus produced and almost simultaneously correctly distributed.



The brush should always be held by the extreme end between two fingers, never by the middle or near the hairs. *The more lightly and more delicately the brush is managed the better it works.*

It is best to begin the work at some characteristic place of the picture, which is well known to the worker; the ink should first be spread as delicately and evenly as possible on a small spot, avoiding, as far as possible, going over the same place twice with fresh ink. When the place selected has been covered with a light film of ink, the surface should be hopped over with light movements, when, with correct preparation of the print, the outlines will soon appear. *A bromoil print correctly prepared, and with swelling suitable to the ink used, is easily recognizable by the fact that the image appears delicately but distinctly under the very first strokes of the brush.* If this does not happen even after some time, either the degree of swelling of the print is too low or there is some fault in the preparation of the print, such as, for instance, unsuitable paper, a poor bromide print, errors in bleaching, etc. The longer the hopping continues, the more distinct the details should become. Then the application of the ink should be continued in places adjacent to those already worked up, until finally the whole surface of the print has been evenly gone over with ink and the image is visible in all its details, although still very thin and delicate. It is advisable to use a rough print from the negative as a guide.

*Beginners usually make the mistake of jumping from one spot to another without filling up the intervening parts.* This makes the work more difficult. Inking up should be carried out continuously by passing from those



places already worked on to those not inked up. If it is noticed that the places which were first inked up appear too pale compared to their surroundings, since they have still too little ink, they should be inked up more strongly. Too dark spots should be evened out with the brush by removing the excess of ink and depositing it on the less inked parts. The amount of ink used on the print is very small; that which is first taken up by the brush lasts for a long time. It is not necessary to have frequent recourse to the ink spread on the palette by the knife, but is much better to take up, as long as possible, fresh ink from the spot on the palette on which the brush was dabbed.

*On the other hand, however, every application of the brush to the print should actually deposit some ink on the print.* If those parts touched by the brush do not increase in intensity, *it must be determined whether the dark places on the palette from which ink is supposed to be taken, are actually giving up ink;* for if the film of ink remaining on the palette is too thin, fresh ink must be deposited and distributed on it by the brush.

Care should be taken not to overload the brush with ink, for then the hairs stick together, distribute the ink badly on the print and, moreover, frequently leave large coherent particles of ink on the film, thus causing spots. As the brush is cut on the slant, it may happen that in dabbing out the brush on the palette and in the application of the ink to the print, the front and longer part of the brush is used more strongly. Then the ink collects at the back edge of the brush and causes spots when the brush is used more vigorously.

In many cases it is possible to complete the print with the hard ink alone. *If it is noticed that the hard*

*ink does not take well on the print and is removed again in lifting the brush*, its consistency is too stiff for the work. One should not then continue to use it, but should *soften the ink* in the following manner: First place the brush in the hard ink and dab it out well in another place on the palette. Now dip the ends of the brush hairs carefully and very lightly into the soft ink and dab out the very small quantity of the soft ink taken up by the brush on the same spot, on which the hard ink has been previously distributed. There is thus formed on the palette as well as in the brush a mixture of the two inks. Now try carefully whether the now softened ink adheres well to the print, by placing the brush lightly on a light place of the print. If it leaves behind a *light* trace of ink without any trouble, the consistency is correct; but if this does not happen, the ink must be diluted again in the same way with the soft ink. If on the other hand the brush leaves behind a *strong* trace of ink from a light touch, the ink is too soft and requires the addition of some hard ink. *It is not advisable to mix the soft and hard inks on the palette with the knife, as it is very difficult to strike the right consistency in this way.*

This applies to all mixtures and dilutions of the ink which may be necessary in the course of the work, as in strengthening a colored ink with black, or in the preparation of any desired tint by admixture of different inks, and finally in softening inks with varnish. In all these cases mixing of the inks on the palette with the knife puts too much ink into use; also, as long as the ink is on the palette, one cannot estimate with the necessary exactitude either the tint or the consistency. The correct procedure is rather first to go

with the brush to the first color and distribute this on a clean place, then set the same brush in the second color and make the mixture on the palette by dabbing. Then the mixture thus obtained should be tested as to its shade of consistency by gentle application to the print, and more of one or the other ink added in the same way with the brush. It should be noted that inks of a soft consistency go a very long way; the whole surface of the brush should never be dipped into such inks, but only the point of the brush. Softening of the inks with varnish should be effected in the same way.

When the first inking up is finished, the addition of ink of the same consistency is continued until the print is completed or will no longer take ink, which, as has already been pointed out, is known by the fact that the newly applied ink no longer adheres, but that the brush removes it from the print. Then one proceeds to a further dilution of the ink by taking more soft ink with the brush and adding it to that already mixed, and continues the work. The use of the unmixed soft ink is not even necessary in many cases. If, however, it proves to be necessary, it should be used, but with care, for a brush stroke which puts too much soft ink on any part of the print, especially in the shadows, causes a patch. *The beginner will work most easily and successfully if he always keeps the applications of ink as delicate as possible and obtains depth only by a repeated and even coating of ink, fully distributed every time.* If a place should still turn out to be too dark, one can try removing the excess of ink, if it be a hard one, with a clean brush. If a dark patch is formed by too vigorous application of a mixed or even a soft ink, another brush should be dipped into the hard ink,



dabbed out, and the spot removed with this brush. Moreover, such places can as a rule be easily rectified after the second soaking of the print, which will be described presently. If the fault cannot be removed in this way, the ink must be partially or entirely removed, according to the instructions in Chapter III, page 73, and the work begun anew. This should be done without hesitation by the learner if the application of the ink does not succeed as he desires; the prepared print can be used for practice like a school slate by washing it off after each attempt with a solvent of the greasy medium.

For the application and the hopping off of the ink for large areas of the print one should *always use the whole working surface of the brush*. Smaller surfaces or outlines should be worked up with the front edge of the slantingly-cut brush; in laying on the ink one should never continue with the point, because this bends and gives unpleasantly sharply defined ink edges. *In order to cover a place with ink very thoroughly, one should hold the brush firmly, give it a slight twist and then raise it up straight and slowly*. If it is desired to coat a whole print evenly with ink, it should be applied in stripes over the whole print, the brush being pushed forward and not necessarily completely lifted up from the surface. The brush is pressed down firmly, the pressure relaxed a little, the brush moved forward half its width, then pressed again, and so on. In this way with a little experience there may be produced perfectly even ink stripes which bring out the outlines of the image and which are made close together until the whole print has been gone over, when one begins with the hopping. With papers with marked structure these stripes are



best made in the direction of the structure and not at right angles. *Especial care should always be taken that the shadows of the print, which take the ink most easily, are not too strongly inked up, and one should try by light hopping to bring out all the desired details at the very first application of the ink.* When the shadows have once taken too much ink, it is not easy to clear them up by brush work alone. The inking up of large deep shadows must always, therefore, be very carefully done. Such parts of the picture are the most strongly tanned and therefore take the ink very readily and hold it very tenaciously. They should therefore never be touched with a brush freshly charged with ink, but one should work on the heavier shadows only when the brush has given up the greater part of its ink to the less sensitive parts of the image. Even then it always contains enough ink for the darker parts of the print. The first application of ink in the shadows, especially, ought never to be heavy and cannot be kept too delicate. When the desired details in the shadows appear to be well defined, they should then be strengthened. But even this should not be effected by a single thick coating of ink, but by successive additions of thin ink films and hopping after each.

Especial emphasis must be laid on the statement that *all details, which it is desired to have in the finished print, must be brought out by the first application of the ink.* If parts of the image are strongly inked up before the desired details have appeared, it is difficult to develop these later. On the other hand, detail, which has been brought out in the first inking, cannot be suppressed by any further skilful application of ink, but only strengthened.

These phenomena can on the other hand be successfully used to prevent the appearance of undesirable details in the picture. If for artistic reasons one desires to suppress detail and work flatly, the parts in question should be inked up from the start more strongly and evenly, and the hopping be either entirely omitted or stopped before the details which are to be omitted are brought out.

For beginners especially, it is useful in applying the ink, as well as in hopping, to lift the brush after every few strokes and examine the results obtained, so as to decide on further procedure.

One should accustom oneself to examine the print *from time to time at a certain distance*, while it is being worked on; for the correct impression as to whether the tonal values are correctly chosen, can be gained only at a greater distance; it is then seen more easily and clearly whether or not individual parts of the print carry too much or too little ink.

Particular parts of the print, which one wishes to have *more contrasty*, should be gone over after the hopping with *a wiping motion of the brush*; the ink is thus removed from the raised parts of the relief. If one goes too far in this, the inking can be done over again in the usual way.

If it is desired to free a brush from the soft ink, it should be dipped into hard ink specially spread on the palette for this purpose, and dabbed out well on a clean place, and this operation repeated two or three times, using each time another part of the palette. At the end of this manipulation the brush will practically no longer contain anything but hard ink.

When one has once learnt the initial steps of brush

technique, in the course of time one fails to notice the difference between the laying on and the hopping off of the ink. *The hand in time acquires an instinctive handling of the brush, which takes care at once of both the application and the distribution of the ink*; if the proper relation between the consistency of the ink and the degree of swelling of the gelatine has been hit upon, a simplified handling of the brush comes of itself, because then the application of the ink is especially easy.

When, with papers of rough surface, the grain of the paper remains white in the shadows, in spite of hopping, such places should be treated by going over them with the inked brush with light pressure *with a rotary motion*.

*Practice teaches that there is always a definite consistency of ink which corresponds to a definite degree of swelling* and with this the print may be executed from start to finish. If the operator has learnt by experience what ink consistency corresponds to the existing swelling of the film, he will prepare his ink of the suitable consistency, and is then in a position to carry out the work uninterruptedly without any new mixing of the ink.

It is a little difficult for the tyro to answer the question as to *when the application of the ink should be stopped*, that is to say, when the print may be looked upon as finished. There is frequently a temptation to consider the print finished when it is very delicate yet completely visible in all its details. The beginner often lacks the courage to apply more ink at this stage; he usually believes also that the print will take no more ink, because, as has been mentioned above, the part of the palette from which he has hitherto taken the ink, gives up no more. Such prints, which recall sketchy



pencil drawings, deceive one during the work, but only satisfy later if this particular technique is suited to the character of the picture, which is certainly not always the case. One must therefore carefully consider during the work whether one should actually stop.

The second danger lies in the opposite direction, and is due to the fact that, led on by the constantly increasing vigor of the image, *one cannot rightly decide when to stop*. The danger here is that one is tempted by the vigor of some part of the picture to make the other parts also as strong in color, until by such continued action the print is immersed in the deepest gloom, which becomes still more gloomy after defatting the finished print. Such excess must be avoided as a rule. Experience and taste soon teach one to hit the happy mean.

The first, delicate and general application of ink, which may be considered as a guide print, is in many cases somewhat wearisome, especially when the picture has large areas of rich, deep shadows. With correct preliminary treatment of the print there are no real difficulties in the preparation of such a guide print. Yet the work, especially with large sizes, is really time-consuming and also offers, when considered from the artistic standpoint, but little interest, since the actual creative work of the operator only begins after the guide print is finished; only then is he in a position to actually give expression to his artistic feelings by suitable inking of the different parts.

Since, therefore, the work in the preparation of the guide print is actually quite mechanical, it is natural to make use of any means which enables one to facilitate and hasten this work.



For this there may be used, but only by the expert worker, a method based on the following considerations:

If an ink of suitable consistency is dissolved in a suitable solvent, such as benzol, carbon tetrachloride, trichlorethylene, etc., the pigment is very evenly disseminated in this solvent. If the latter again evaporates, the ink deposits in an even coating, unchanged in its nature.

It is therefore, possible, in the first application of the ink, to use such a solvent on the print and by its aid the wearisome mechanical work of the first inking may be rapidly and easily carried out.

In practice the method of procedure is as follows: there is first produced, on the print which is to be worked up, a relief which is vigorous enough to sufficiently develop all the detail in the shadows. An ink which is fairly stiff for this degree of swelling is chosen; the brush is first dipped in the solvent and then into the ink, which has been thinly spread on the palette. After a few dabbings on the palette the ink solution with which the brush is charged is spread on the print with a hopping motion and distributed with the same brush as evenly as possible. If the distribution becomes difficult in consequence of evaporation of the solvent, the brush should be again dipped in the solvent, and then the distribution can be easily completed. The film of ink thus obtained should be fairly thin, but must not be quite even.

After the complete evaporation of the solvent, the ink is worked up with a clean brush, with which the guide print can be finished without trouble and in the briefest time.

There are also other variations of this method of

the application of dissolved inks. For instance, one may first apply some ink with the brush to the print and then distribute it with a second brush dipped in the solvent; one may also prepare a solution of the ink in a dish and paint it on the picture, or bathe the whole print in a solution of the ink. All these variants, especially the last two, have, however, certain disadvantages, so that the procedure first outlined is to be preferred.

After the guide print is prepared in this way, the further application of the ink is carried out in the normal manner.

The solvent is most conveniently chosen so that it is not too volatile, as for instance heavy benzol. But it ought not to contain any oil. When placed on the surface of the hand, it should evaporate fairly slowly, but without leaving any trace of grease.

Certain failures, which sometimes appear in this process, must be mentioned. If the film of ink is too thin, it can be repeated without further trouble in the same way, with rather more ink. If, on the other hand, too much ink is applied, a complete image is immediately formed without any possibility of the shadows being worked up. In this case the ink must be again removed by the solvent. If individual parts of the picture are too dark, from too much ink, it is sufficient to go over these parts with a brush dipped in the solvent, in order to clear them up.

If, after evaporation of the solvent, great irregularities in the distribution of the ink are seen, as for instance, spots and streaks which cannot be easily worked out, the print should again be placed in water; after drying off, the evening-up may be carried out without difficulty.

If in hopping with the second clean brush the image does not appear at once without trouble, either the relief was too low, or the ink too soft, or the solvent contained oil.

The ink can obviously be placed on the bromoil print not only with the brush but with any other suitable ink carrier, such as *rollers*. Yet by this the process is rendered *more mechanical* and deprived of all those great advantages, which distinguish it from all other printing methods. *Especially, the possibility of local treatment is mostly lost*; the unlimited command of the tonal values and the structure of the ink can only be guaranteed by the use of the brush. The only offset to this loss is a gain in speed. Agility, however, is not sought after in artistic labors. If one wants to prepare a lot of prints quickly, it is better to use the bromide process, which is especially suitable for such a task, and thus save the trouble of the bleaching and the other processes necessary in making bromoil prints.

#### RESOAKING OF THE PRINT DURING THE WORKING-UP.

— *Resoaking the print during the inking up, without regard to the existent film of ink, is one of the most important aids in the bromoil process.*

This procedure is based on the following considerations: It has already been pointed out that the prepared gelatine film possesses the property of again assuming after drying the same degree of relief which was imparted to it by the warm water bath. When a swollen print is taken out of the water and placed on the pad for working up, evaporation immediately begins at the surface of the film; the gelatine, therefore, continuously gives up water to the surrounding air during the work, and more quickly in proportion as the air is drier and



warmer. As has already been mentioned, the damp pad does not alter this, since the supply of water from the pad through the paper is not sufficient to restore the water content of the film. Therefore, while one inks up one part of the print, all other parts gradually lose their water; and since it is this water which renders the gelatine, after its tanning, capable of repelling or taking the greasy ink, the work gradually becomes more and more difficult. The gelatine film, which feels smooth when the film is removed from the water, especially in the high lights and any exposed margins, becomes gradually leathery. It may still take ink, but the distribution of this, and especially the development of the drawing and the details, become more and more difficult.

*If, however, the print, which is partly or entirely inked up, is again placed in water and this time in cold water, the gelatine film very rapidly absorbs this and again attains the same degree of relief that it had at first.* Sometimes it appears as though a marked clearing up of the image takes place in the water; the high lights become cleaner, and many details appear in the shadows which were not visible during the working-up. On the other hand, with some inks the picture appears to become weaker under the water. This, however, is only an illusion and is of no importance, as in drying, or in again going over the picture with the brush, the image again attains the previous depth and color and still greater clearness.

Here also, one must take care that the print is *completely immersed* and that no air bells adhere to the film, since those places to which the water does not have access do not reswell, and on further work may give rise to spots. In removing the print from the water



the inked-up surface should not be touched with the fingers, or finger prints will remain in the ink. The print should therefore be taken hold of by the edges.

While the print is soaking in the water, the bringing out of the details, especially in the shadows, may be facilitated by stroking those parts with the tip of the finger or a swab of absorbent cotton. In the same way dirt which has collected on the surface during the work may be removed. In the latter case one may also use more vigorous friction, even though the ink film is thus removed, since the removal of the troublesome particles is more important than saving the thin film of ink, which can be easily renewed.

The print is then removed from the water, placed on the pad, and dried as previously by spreading over and pressing down a lintless cloth, although because of the film of ink any wiping action should be avoided. Then when the brush work is resumed, it can be completed in an extraordinarily easy manner.

It should be specially noted that the print must be *worked up after this second soaking with the same brush as before, which need not be recharged with ink.* Only after the print has been hopped in this way, should fresh ink be applied.

During the work, the bromoil print, as a rule, will scarcely retain the necessary degree of dampness longer than a quarter of an hour, and not this long in dry and warm weather.

*The resoaking of the print should be undertaken without hesitation as often as any difficulty in the distribution of the ink is met with; for this saves a great part of the brush work, and almost automatically brings out contrasts and details. Especially while learning the*

process and later with more difficult prints, the work is most conveniently divided as follows: first application of the ink and distribution by hopping, as long as it is easy; resoaking the print; drying off and hopping anew with the brush not freshly charged with ink; second application of the ink and hopping of the ink now applied; another soaking, and so on. The operation may be repeated as often as desired without the film taking any harm.

Because of the possibility of always bringing the print to the correct degree of relief during the brush work by means of resoaking, *there is absolutely no limit to the size of the bromoil print*. One can simply finish a part of a print of any desired size and then, after another soaking, go on to the next part and so on until the whole print is inked.

If the relief of the film corresponds to the desires of the operator, the bromoil print may be finished completely in this way. *If it is seen that the relief is not sufficient to give the desired modeling and contrast, the resoaking may be effected with warmer water than was used at first*. Yet, until the worker has completely mastered the process, this should be done carefully and the temperature of the water gradually raised by adding hot water, in steps of not more than five degrees, until the requisite relief is attained. The use of a *thermometer* is here absolutely essential, for the estimation of the temperature of the water by the hand is quite unreliable and may lead to the greatest errors. This applies to all water baths used in the bromoil process. At this point it should be noted that a print, which on account of its characteristics has to be placed at the beginning in very hot water to attain the necessary re-

lief, is usually covered with very tiny air bells, which can easily be overlooked; they must be removed by wiping under water so as to avoid troublesome spots.

If the relief of the whole print is satisfactory, but, because of the character of the negative, a few places in the deep shadows do not show the necessary details, the desired shadow detail might possibly be attained by increasing the whole relief, yet at the same time the relief in the rest of the image would be carried too far. In such cases, the places which should be relatively more swollen can be separately more highly swollen while the rest of the surface of the print retains the original relief, by pressing on them a cloth soaked in warm water or a suitably formed swab of absorbent cotton. A still stronger effect is obtained when such places are painted with a water-color brush charged with a one per cent solution of ammonia, either on the film or, after previously marking the outlines, on the back.

When the relief of the gelatine has been increased by soaking in water which is warmer than that used for the first bath, certain precautions must be observed in removing it from the water. It frequently happens, when using certain inks, that *the water which runs from the film causes streaks and spots*, and that evening these out is at least troublesome and frequently very difficult. This action, which does not occur when resoaking in a bath of the same or a lower temperature, is explained by the fact that the greasy medium of the ink is liquefied by the high temperature of the water, and runs down irregularly or mixes with the water and is carried off by it. There are thus formed on the film of ink marks which show the form of the streams of water which have run off. Such troubles may be avoided by bring-



ing the support close to the dish in which the print is soaked, lifting the print out of the water as far as possible in a horizontal position and placing it in the same position on the support, and immediately spreading the previously dried cloth over it and carefully drying. By observing this precaution, the running off of the water from the film, which is the cause of this difficulty, is prevented. Any traces left by the cloth, used for drying off, can be easily evened out again by the brush.

By making use of this soaking of the print during the work, the bromoil printer *is absolutely unlimited in the time used for his work and is not driven by any necessity for haste*. He can continue his work in peace and without hurry, and devote himself to any particular part of his picture at will, without being afraid that other parts will meanwhile lose their capacity for being worked up.

THE REMOVAL OF THE INK FROM THE SURFACE. — If, in the application of the ink, a fault occurs, which for any reason cannot be corrected with the brush, or if one sees in the course of the work that the ink film is not satisfactory in tonal values or shading, the print would have to be discarded, if it were not possible to remove the ink without damage to the film. This is feasible, however, without any special difficulty; one need not, therefore, throw away such a print, but after removal of the ink can again ink it up, but this time with avoidance of the previous fault.

*If there are only small faulty places, the ink may be removed from the print as it lies on the pad, as follows:*

Cut a small piece of transparent, waxed paper, or, lacking this, of thin smooth white paper of approximately the shape of the over-inked spot, but slightly



larger, and place it on the faulty spot, turning up a little corner so as to be able to lift the paper again. Then rub with the finger tip carefully and pull off. The ink is thus removed from the bromoil print and transferred to the paper. If the removal is not complete, the operation is repeated with a second piece of waxed paper. If very small places, as, for instance, the eyes of a portrait, have to be dealt with, the rubbing should be done with a round stick, such as a penholder.

*By inking again, the part that has been thus removed may be replaced without any trace of a correction.*

If the whole film of ink is to be removed from a bromoil print, *a soft dry cloth or better still a swab of absorbent cotton should be soaked in benzol or other solvent, and the picture washed with it.* The medium of the ink is dissolved by the benzol and the ink taken up by the wiping cloth.

Every stroke must be made with a clean portion of the swab, which must frequently be soaked again with benzol, otherwise the ink dissolved by the benzol and taken up by the swab will be again put down on the paper. If, after washing with benzol some traces of ink still remain on the film, the print should be *immersed in water, but only after the benzol has completely evaporated not only from the film but also from the fibers of the paper*, and it should then be gently wiped with the finger. Even if the film still shows a slight tint after this, the working-up may be begun again successfully, since the traces of the previous inking disappear under the new application of ink.

This complete removal of the ink with benzol may also be repeatedly effected. *Beginners can, therefore, use any prepared print several times for experiments.*

But experts should not think of washing an unsatisfactory print with benzol. Those who possess a transfer machine can remove the film of ink mechanically in the simplest way by transfer.

*If it is desired to remove the ink from very small portions of the print*, this is most easily effected by repeated use of *art-gum*, which should be sharpened to a point. After every application of the art-gum, a fresh surface of the gum must be used, so that the ink is not again transferred to the picture. It should be noted, however, that repeated use of the gum on the same spot may cause blisters.

FAILURES. — To assist the beginner, some possible failures will be here described.

It may happen that during the inking *the print becomes covered with fibers and small hairs of the most different shapes*. This phenomenon may sometimes become so troublesome that a successful print appears problematical. It is frequently *incorrectly assumed* that these impurities are *caused entirely by the brush*. Hairs that have fallen from the brush are always recognizable as such, for they are straight, relatively thick, lie entirely on the surface of the film, and can be easily removed. When there is an excessive appearance of *fibers*, they are due to the use of an unsuitable cloth for drying. The fibers are of the most different shapes, from dots to recurved and entangled lines.

From the fact that they always appear most strongly and frequently during the inking up, it is frequently erroneously assumed that they are caused by the brush used for the inking, or that dust is deposited from the air; this is not so. A dirty brush may be to blame; mostly, however, they are fibers of very different shapes,

which are brought on to the damp and somewhat tacky gelatine film by the pressure of an unsuitable cloth, which is not free from lint, and they are held fast by the gelatine and torn from the cloth as this is lifted. At first these thin and almost transparent fibers are not visible. But they take the ink, and thus it happens that they seem to appear in ever increasing numbers during the inking. If *individual* fibers (which may come from an otherwise suitable cloth), or brush hairs that have fallen out, have to be removed, this is readily effected by *art-gum*, worked to a point with the fingers. With such a point long fibers can be very easily lifted from the film, while the tiny cloth fibers cling very firmly to the film. A small white spot, where the gum point has touched, remains, as this removed the ink also from the gelatine. Such points can be completely closed up by repeatedly going over them with the brush.

Single hairs or fibers lying on the surface may be allowed to remain, when they occur in places where for any reason one must not destroy the ink film; they can be very easily removed from the film with a sharp instrument in the after treatment of the finished print; usually they leave scarcely any mark.

If, on the other hand, the fibers have appeared in large numbers, the print should be immersed in water and one should try to remove them by gentle friction with the tip of the finger, which is generally successful, even if the film of ink is also removed at the same time. If, however, the fibers adhere so firmly that they cannot be removed in this way, which is particularly likely to happen in the shadows, the whole coating of ink must be removed in the manner outlined in the previous section, page 73.



The only safeguard against the appearance of this difficulty is the use of a material as free from lint as possible for drying the film.

It may happen that *the print takes the first hard ink instantly and very readily*, but that even with long hopping clearness of the details is not obtained; the picture indeed shows up well, but remains muddy, as even the high lights retain the ink and become darker with further application of the ink. Then, as a rule, the requisite relief has not yet been attained, and the print must be placed in warmer water. If all the instructions for the development of the bromide print, the bleaching and the swelling have been adhered to, and success is still wanting, then the fault lies in the paper, which was hardened too much in manufacture. The bromoil process is based on the fact that the shadows are tanned more than the high lights, and that then the tanned places take up more ink than the untanned. If the whole film was completely hardened from the start, there cannot be more tanning added by the bleaching, and the ink will take everywhere, in the lights and in the shadows.

*If the high lights of the picture completely repel any grade of ink*, while this adheres thickly in the shadows, then the formation of the relief has been forced too far.

If the print *takes the ink neither in the high lights nor the shadows*, there is either a fault in the preliminary preparation, as, for instance, bleaching in too warm a solution, or one too strongly acidified, or the print has been acted on too energetically by the ammonia bath. In the last case the print may be dried and again swollen in water.

*If large or small irregular spots* which take the ink



more strongly than the surrounding parts, *are formed during the inking*, the reason is either that the prints have lain one on top of the other in the preliminary baths, or the film has been prevented from swelling by air bubbles, or by having risen out of the water. Thus certain places are less well prepared or are not swollen, and therefore behave as though they had been more strongly tanned, that is to say, they take even the first ink strongly and stand out from their surroundings as spots and streaks. Sometimes such spots are improved by putting more ink on the print; if they are not of large area and are in the less important parts of the picture, they may be ignored, as they can be removed from the finished print without special trouble, as will be explained later. If, however, the spots have a large area, or occur in an important part of the picture, for instance, in the eyes of a portrait, it is preferable to stop further work. As a matter of fact, all such blemishes may be removed by after treatment of the print, but the trouble entailed by the correction of large faults is greater than the work of preparing a new print.

Sometimes darker spots or streaks of irregular outline show themselves during the work, which from their shape cannot be ascribed either to air bubbles or to partial sinking of the relief. Then there are probably irregularities in the gelatine coating, for which the preliminary treatment of the bromide print is not responsible.

If the print shows a satisfactory relief, but still takes the ink badly or not at all, the reason is in the incorrect composition of the bleaching solution, or the *omission of the intermediate drying* after bleaching.

Finally it may happen that the image *appears* almost as a *negative* during inking-up, since the high lights

take the ink quicker than the shadows. This phenomenon appears when the intermediate drying after bleaching has been omitted, or if *the work has been begun with too soft an ink*. In such cases, if too much ink has not been applied, the fault can be corrected by further working-up with a hard ink. If this is of no use, all the ink must be removed from the faulty places in the manner already described.

If during the inking-up *small irregular white spots in groups* show themselves and shift their places, then there are drops of water in the brush or on the print. The print should be dried, the brush also, and the spots hopped dry and worked over.

*Yellow or brown spots and patches*, which often appear during the work, increasing in number and continually enlarging, or even penetrating through the film into the fiber of the paper, are to be ascribed to the fact that particles of amidol were deposited on the film before the soaking of the print. When these particles dissolve in water they cause the trouble just described. If there are merely scattered spots of this kind which have not penetrated the paper, they may be scraped out of the finished print and then retouched. The real remedy, however, is in keeping the amidol carefully closed and as far as possible not in the same room as the prepared prints.

*Ink streaks*, which a print treated with a soft ink shows when it is taken out of the warm water, only appear when the print is placed in a slanting or vertical position; they can be avoided by taking the print from the water and immediately bringing it into a horizontal position on the support and rapidly drying, so that the water cannot run off.

The failures caused by the use of the ammonia bath were described on page 46.

ALTERATION OF THE CHARACTER OF THE PICTURE BY THE INKING. — If the inking is carried out exactly according to the previous instructions, which have been given chiefly for the benefit of beginners, the result will be a picture which, as regards gradation, will be like the original bromide print before it was bleached. The finished bromoil print, produced by a perfectly even application of ink over the whole picture by means of successive additions, each thoroughly worked over with the brush, differs from the original bromide print in coloration, structure, more extended gradation, and change in the character of its surface. As the worker is at liberty to stop at any desired stage of the work, he can obtain from the original bromide print, according to his taste, a delicate light-toned bromoil or a very rich and highly modulated print, or any intermediate stage between these two extremes.

Yet these possibilities by themselves alone would not justify the conversion of the original bromide print into a bromoil. The substitution of a new photographic positive process for an old one is only justified if the new process accomplishes something essentially different and above all something better. But absolutely uniform working over of the bleached bromide print with greasy inks does not completely fulfil this postulate. Mere changes of gradation of the whole picture or of its color can certainly be attained by simpler photographic methods. The extraordinary advantages of the bromoil process lie in other directions.

*Bromoil printing, for instance, permits us to ink any individual part of the print more or less, or even not*



*at all, at will*; it is possible to give enormous brilliance and aerial perspective to the high lights; they may show when finished every tonal value represented in the negative; it is also possible to darken them to an extraordinary extent by the application of more or softer ink. On the other hand, the shadows may be kept perfectly light by omitting to ink them or by very delicate treatment, or, by successive applications of the ink, they may be strengthened to very great intensity and yet retain all their details.

*The worker has wide opportunity for control in the local treatment of his prints. His dependence on the negative is limited to the drawing, while in the treatment of the tonal values he is absolute master.* Most of the other positive processes are dependent on the negative for their extremes of depth and of delicacy; the bromoil process does not know this dependence. If it is desired to obtain a delicate picture from any negative, one uses only 'a little ink, and hops it off thoroughly; then there may be obtained from even *the most contrasty negative a delicate print, but one thoroughly worked out in all its details.* On the other hand, there is practically no limit to the continued application of ink; the film is still capable of taking up more ink, long after the limits of artistic pictorial effect have been passed. The result is that in the bromoil process *vigor and depth of the shadows can be produced in any desired intensity.* The most striking advantage of the process lies, however, in the possibility of changing the tonal values of any individual portion of the print at will.

If for example, a negative was used in making the original bromide print which had been taken without



any attention to the requirements for getting correct tones, by suitable treatment in making the bromoil one can obtain an approximately correct print without special trouble, since one can, for instance, convert an absolutely clogged-up sky, which is pure white in the bromide print, to a suitable grey tone by the use of soft ink, and at the same time lighten foliage which is too dark; a flat print, wanting in plasticity, may be improved by making objects in the foreground more vigorous, and accentuating appropriate parts of the middle distance. It is easily possible to supply the lacking aerial perspective of certain kinds of prints. In portrait work in the bromoil process, skilful workmanship renders one absolutely independent of the nature of the background. A light background can be made dark, a dark one light. In portraits taken out of doors, the small details of the background that are out of focus or obtrusive may be omitted, toned down or completely remodeled. Unpleasing details of the clothing or the hair can be omitted or so far softened down that they are no longer disturbing. We are able to accentuate certain parts of the picture to make them dominant, while other parts of the image may be treated very sketchily; in short, the possibilities of control which this process offers are almost inexhaustible.

I will now try to outline the methods of carrying out some of these modifications, as far as is possible without practical demonstration.

The beginner is first of all recommended to use a proof print from the negative as a check, so that he may have a clear idea as to what changes he needs to make, and so that further, in carrying out his ideas, he does not change neighboring parts of the print which

should remain unchanged. The simplest example of control is the *lightening of the shadows*. This is done by very careful application of the ink, which is stopped before the shadow parts become too dark. One should avoid touching such parts later with the brush, when it is charged with soft ink.

If light portions are to be made darker, the procedure depends upon the size of the parts involved. Extensive parts of the picture in high relief, as for instance the sky, should be gone over as evenly as possible with a suitable soft ink, and with this, simultaneously, by going lightly over the lighter places and applying it more heavily here and there, clouds may be put in. The evenness of the inking is of the greatest importance here, as it cannot later be hopped off very much; frequently in such cases the ink only lies on the surface, without adhering firmly; if left untouched, it combines intimately with the surface when the print is dry, but is easily removed by hopping. It is possible to change the outlines of neighboring parts of the image; if too dark edges are formed, they can be easily softened by after treatment of the finished print. In some cases it may be necessary to add considerable quantities of varnish or linseed oil to dilute the ink. The darkening of too light places may be also effected by dabbing ink with the brush on the finished dried print, which the print then naturally takes all over.

*If tiny light patches are to be made darker*, the point of the large brush, or if necessary of a very small brush should be used, avoiding any disturbance of surrounding parts, as far as possible. Such changes are difficult only when the bright spots that are to be worked out are in immediate contact with very dark parts. The process

is much simpler when parts of the print of medium tones, which are surrounded by lighter parts, are to be darkened. If, for instance, the eyes of a portrait are to be darkened, ink should be applied to the whole of the eye with a small brush, and then hopped off. A tree trunk, which must be brought out in relief, should be covered throughout its whole length with soft ink, and the ink should then be worked over, by hopping it from the lighter toward the darker parts. In practice, the bringing together of neighboring tones, which differ considerably in value, can be easily effected by *hopping off the ink from the darker parts* with a brush that has not been freshly charged with ink, *and depositing it on the lighter parts*. The lightening of too dark places can also be attained by going over them with a perfectly clean brush that has not been dipped in the ink. Isolated high lights can be accentuated by touching them with a pointed water-color brush, dipped in water; then the film swells and repels the ink. *Stained high lights or too dark middle tones* may be lightened by wetting a brush of proper size by means of a wet cloth and then lightly hopping with this the places which are to be corrected. The brush picks up the color, but must be immediately cleaned by rubbing it on a clean portion of the palette, after which it may be again wet and used again. Clouds can be worked into dark parts of the sky in this way.

THE STRUCTURE OF THE INK. — Independently of the surface of the paper on which the work is done, *the structure of the coating of ink can be influenced by the nature of the brush work*. If a brush well charged with ink has its full surface placed firmly on the gelatine film and then slowly lifted up, an impression of the



surface of the brush remains; the individual hairs or groups of hairs of the brush have each deposited a part of the ink that they had taken up, and a very coarse-grained spot of ink is produced. If we now hop, that is, dab with quick light blows of the brush, the ink begins to be distributed, since it is taken away from the lighter parts and taken up by the shadows. The drawing of the picture *thus appears under the brush, at first with a very coarse grain and without many details*. The longer one hops and thus distributes the ink, the finer becomes the grain, and it especially becomes much finer on the addition of softer ink. *The bromoil printer hence has it completely within his power to limit the division of the ink to any desired coarseness of grain*, assuming, of course, that he has suited the consistency of the ink to the degree of relief, and is therefore able to completely finish the print with the original ink without adding any softer. Prints may thus be prepared, which because of their coarse structure, resemble certain graphic methods. But, when this is intended, the application of the ink must be carried on as evenly as possible from the beginning, so that it needs very little hopping off, for any considerable amount of hopping unavoidably produces a finer grain. Even if the use of softer inks is necessary, a coarse structure can be obtained by suitable brush work. *The longer, however, the ink is distributed by hopping, the finer becomes the structure of the ink film and the smoother the surface.*

*The most perfect smoothness is also attainable*, if it is desired for any reason. For this a not too volatile solvent should be used, such as heavy benzol. The method of using this is as follows: when the print has been fully inked and is complete, though still somewhat



coarse-grained, a cloth should be wet with the benzol, and the brush lightly pressed thereon and then passed quickly over the desired parts of the picture. At first a smeared spot is formed on the surface of the print; by continued gentle hopping the spot is gradually worked out, and by continued working we get a fineness of detail, equal to that of printing-out paper. It is true that even the highest lights acquire a delicate film of ink, so that a print treated in this way is somewhat low in key. If the hopping with the brush charged with benzol is not continued until the finest possible grain is attained, a misty effect may be produced, with some suppression of the finest details; a method which is frequently useful in the production of landscapes.

By suitable ink and brush technique the effect of any other known photographic printing process may be attained in bromoil printing, from the rich-in-detail gloss of collodio-chloride paper to the characteristic effects of gum-bichromate. Yet the far-reaching possibilities which bromoil places at our command really only begin where most of the other processes end.

DIFFERENT METHODS OF WORKING.—In the following pages some of the different methods of technique, which the bromoil process permits, will be briefly sketched. Obviously, however, the description of these methods cannot be made complete without practical demonstration. Nor can all conceivable methods of working be mentioned, as individual treatment of the process can be varied in many ways.

We will first describe the method of working which is most suitable *for the beginner*, because it offers tolerable certainty to those who have not yet mastered the process.

The beginner, in order to obtain good results, must start with a bromide print as clean and well-modeled as possible, and its high lights should not be fogged in the least. He should place the print, bleached and prepared exactly according to the methods detailed in this book, in water at about 18° C. (65° F.), leave it there for a few minutes, dry its surface, and begin the application of the ink with the stiffer ink, which should be thinly applied and then worked over until the hopping brings out no further detail. If the drawing of the image does not quickly appear upon hopping the print, and the result is only a detailless patch of ink, the original temperature of the soaking bath must be increased. Then the print should be again immersed in the water, left for two minutes, and again dried. The work of hopping is now continued with the same brush with which the print was originally treated, *and without its having been again put into the ink.* As a rule the mere placing of the print in water again will have increased the contrasts, and new details will have appeared, which can be considerably accentuated by now going over with the brush. Only when the print has been again worked over, should fresh ink be carefully applied with the brush; this should then be distributed by hopping, and the print again soaked in water. The procedure thus outlined: application of the ink, hopping, soaking, going over it with the empty brush, fresh ink application, hopping, soaking, and so on, is continued as long as the print gains in strength and depth, without becoming dull or muddy. If, however, this point is reached, the inked print should be immersed in water at a rather higher temperature and left in it for some minutes. The print is then further

treated with the brush, without fresh inking, and will soon become much clearer in the high lights. If the clearing thus obtained is not sufficient, the temperature of the water bath should be increased by a few degrees, but not more than 5° C. (9° F.) at a time. As the high lights become clearer it may happen that the stiff ink will no longer be taken up. Then it is necessary to soften it a little. This method of working will guarantee to the beginner the attainment of good results with tolerable certainty.

HARD INK TECHNIQUE (*Coarse-grain Prints*). — If it is desired to prepare a bromoil print of *rough surface and coarser character*, the worker must be able to finish the print exclusively with a relatively hard ink. For this it is necessary to determine by trial the temperature of the water bath at which the film of the print acquires a relief which is absolutely suitable for the stiff ink. When this degree of relief has been found, the print should be inked up strongly but evenly from the very start, so that one is not compelled to go over individual places several times with the brush. Thus the coarse structure of the ink is obtained. The use of hog's bristle brushes is also efficacious in coarse-grained work.

SOFT INK TECHNIQUE. — This method of working is used on the one hand for the preparation of low-toned misty effects, on the other hand to obtain fully and richly modeled prints. In the first case the bromide print should be correctly exposed, but not completely developed; while in the second case it should be thoroughly developed. The print is then, according to the choice of the operator, either brought at once to a fairly high relief, or only gradually raised to the same relief



during the application of the ink. Then, in the course of inking, a point is soon reached at which the stiffer ink is repelled by the high lights and perhaps also by the lighter half-tones, and during the hopping is again taken up by the brush. Then the ink should be carefully softened with linseed oil or varnish, and the whole print gone over with the softer ink. Prints which are executed in the soft ink technique are characterized by a specially fine velvety surface after defatting.

SKETCH TECHNIQUE. — If one proposes to completely work up certain parts of a print and leave the rest treated in a sketchy manner, and possibly to omit some parts altogether, one should begin by working up the part which should stand out. Thus, in a portrait, the head should be first worked up; then proceed systematically, with the ink remaining in the brush, to sketch in the clothing and the background, and perhaps leave unimportant parts of the print completely untouched. To facilitate the work, disturbing details or a too prominent background may be removed or reduced on the bromide print, before bleaching, with dilute Farmer's reducer. If, when the work is finished, the parts that have not been inked are visible through their relief and glossiness, these traces of the uninked picture completely disappear in drying, if the original bromide print was not developed too vigorously. If one contemplates producing a vignette, it is absolutely unnecessary to obtain this by the use of masks or vignetters when making the bromide print. The effects which result from the suitable treatment of the bromoil print are far more free and beautiful.

If certain parts of the picture are to be accentuated and all the rest is to be rendered visible, even if only



sketchily, one may also work in the reverse way. The whole picture should be given a thin coating of ink, as even as possible, which should be hopped only just enough to barely bring out the drawing. Then work out those parts, to which attention is to be directed, keeping as closely as possible to the outlines. When these, the most important parts of the print, are finished, it is frequently seen that the rest of the picture is too delicate. This should then be gone over again with the ink as at first, without completely working it up, until the correct tonal value is attained. Then the necessary harmony is obtained by going over the outlines with the brush.

LARGE HEADS.—The far-reaching possibilities of the bromoil process offer special advantages for the free modification of tones in portraits. It is advisable to take the portraits with a neutral or dark background. The only exception is when a head is to be done in red chalk, when a white background is preferable. Starting from such a negative in bromoil printing the background may be kept, according to choice, either light or very dark, or be shaded. One precaution should, however, be observed in every case; before starting on the head itself, the background should be worked in lightly from the margins toward the head, so that no dark line may be formed when working on the outlines of the portrait. If this shows during the work, it must be worked down to harmony with the background at once before it gets too dark. One can, therefore, from a given negative, produce at will either a fully worked-up head against a dark ground, or a light, sketchy image on the light background of the paper, or any intermediate stage.

If, as previously suggested, parts of the picture are

to be treated sketchily, while others are to be fully worked up, the parts which should appear sketchy are allowed to remain coarse-grained, while the structure gradually becomes finer in passing into the worked-up portions. No portion, however, should be made perfectly structureless. Bromoil prints thus worked up are much more artistic than those pictures which are known by the name of photo-sketches. The latter usually show a head, printed with all the gradation and fullness of detail given by printing-out paper. The tone becomes gradually lighter toward the edges, where we find some strong lines, imitating the character of a line drawing, all surrounded by a perfectly white background. To the trained eye the technique of such photo-sketches is abominable, for the contrast between the inimitable detail of the head and the perfectly blank background is so great that it cannot be bridged over by the effort to imitate the manner of an etching. On the other hand, such problems can be solved in an artistic way with our process, for the head may always be produced in a rather coarse grain, so that it dovetails harmoniously into the sketchily treated surroundings.

OIL-PAINTING STYLE.—If it is desired to prepare portraits which resemble reproductions of oil paintings, one should proceed as follows: the head should be first inked in considerably deeper than it should appear in the final print; then, if the head is on a light background, it will appear vigorous, even if not much ink is used. If, however, the background is dark and heavy, the inked-up head will appear considerably lighter because of the contrast. For this style of work it is best to select a warm dark brown ink. When the head is finished, some very soft ink of the same shade should

be placed very thickly in the corners and margins of the picture, and this should be worked from all sides towards the head, which naturally must not be touched with the soft ink. Finally the blending of the head with the background should be very carefully done. In the lower part of the portrait the clothing should blend into the background in a similar manner; only one must take care in making the negative that no light pieces of drapery or accessories are used, because they cannot be easily completely covered. Any lighter accents, which may be desired in the background, should be made by removing the ink with a clean brush. One may thus make the head stand out in a dark oval, or attain similar painting effects. Prints prepared in this way ought not to be defatted, as they then lose their similarity to oil paintings. They must be left to dry for several days, in a place free from dust, until the thickly-applied ink has hardened.

NIGHT PICTURES. — Twilight and night effects can be easily obtained from ordinary negatives by carefully swelling the bleached print so that the differences of relief existent in the print are only slightly brought out. Then the capacity of the lights and shadows for taking the ink is not so very different, and the gradation is shorter. A second possibility of obtaining the same effect is offered by using mainly soft ink, which, as is well known, adheres to a certain extent even in the high lights of the print; only the soft ink must be applied very carefully and thinly in the shadows, so that these do not become choked up with ink.

In this way one may make night pictures from daylight exposures, accurately corresponding in tone values to night exposures. Previous practice has been to use



either underexposed negatives or overexposed prints for such effects; in both cases the night effects were gloomy, but false in tone values, and usually without details in the shadows. In bromoil printing the gradation can be shortened as described, without loss of drawing, and one can simulate perfectly the short scale and mysterious gloom of night. If the too dense sky of the negative cannot be sufficiently darkened by the use of soft ink, its inking should be postponed till the print is dry.

PRINTS WITH WHITE MARGINS. — If it is desired to obtain bromoil prints with *margins of the natural paper*, the negative should be masked with clean-cut black safe-edges of lantern slide binding strips, or one may use a mask, and print or enlarge on a sheet of bromide paper large enough to leave unexposed margins of the desired width. In making enlargements the mask, cut out of rather thin card, should be pinned on the enlarging screen over the sheet of bromide paper. After bleaching such a print the tanned image will appear slightly depressed within a strongly swollen, white frame of less tanned gelatine. The inking is done without any attention being paid to this unprinted edge. In consequence of its strong relief this gelatine does not take any ink from the brush, or, at most, a mere trace. When the print is finished, the ink is easily wiped from the white margins by means of a damp cloth, which removes this ink with the greatest ease. The finished and dried print is enhanced in effect if a plate mark is impressed in this wide white margin.

THE SWELLED-GRAIN IMAGE. — Coarse-grain printing in bromoil has previously depended on a very carefully determined relation between the degree of relief of the film and the consistency of the ink, which had to be so

chosen that the ink was not very easily taken up by the film. If inking was then skilfully done, the structure of the face of the brush was visible to a certain extent all over the print and gave the effect of a more or less coarse and irregular-grained image. It was obviously necessary for the success of a print of this type that no portion of the image should be gone over several times with the brush, for, if this was done, the structure was obliterated and the spot in question became smooth. Since, also, the requirement that the degree of relief must be rather high for the chosen consistency of the ink could never be fulfilled by the shadows, since these always take the color easily, we often obtained an undesired smoothness of effect in the shadows. For this reason typical coarse-grain prints could not always be produced with certainty.

I therefore endeavored to improve the technique of bromoil in this respect and to work out a grain method which could be depended upon with certainty in every case. The basic thought was that *the fundamental basis for making a coarse grain print should be a part of the film itself*, and I endeavored to prepare the latter so that a grain structure could be produced which should equally underlie all parts of the image.

Such a grain structure can theoretically be obtained in the following way: if we allow a properly prepared uninked bromoil print, which has been brought to the proper degree of relief, to dry off a little and then spray it by means of an atomizer with extremely fine liquid drops, the film will again swell up under every drop, but only under these; and when we ink up, we obtain a definite grain effect which, however, only persists if the inking is completed before the sprayed-on water

grain again dries out. Such a relief grain is not permanent, because the subsequently swollen portions of the film cannot retain the difference in swelling. This process, therefore, has only experimental interest and practically can be used but rarely.

To make the swelled grain useful, the secondarily swollen points of the film must permanently retain the difference in swelling which has been imparted to them.

To attain this end, I start from the fact that portions of the gelatine which are treated with alkaline solution will swell much more in a bath of warm water than spots which have not been thus handled. If, therefore, the desired grain can be applied to the film by means of an alkaline solution, all the elements of the grain will swell up more strongly in the water bath than their surroundings, and will therefore protrude above the rest of the film and thus attain and retain a better degree of swelling than the latent tanned image.

The next step was obviously a practical treatment of the film by spraying it as evenly as possible with extremely fine drops of an alkaline solution. It soon appeared that the greatest attention must be paid to the type of apparatus with which the spraying was to be done. Any atomizer whose spray combines fine and coarse drops is useless. Any atomizer which is worked by blowing with the mouth or by intermittent blasts of a pump is unsuitable, for at the instant when the stream of air is interrupted, a certain quantity of liquid remains in the mouthpiece and is thrown out by the next blast of air in the form of coarse drops. Therefore, only continuously functioning atomizers can be used, preferably those types which are actuated by double rubber bellows. Only with such atomizers is it possible



to count with a fair degree of certainty on the production of a system of uniformly fine drops. Ammonia, which has previously been generally used in bromoil printing as a swelling agent, cannot be used to produce such a grain, because the ammonia gas volatilizes in great part in its passage through the air. A five per cent solution of potassium carbonate has been found to be most satisfactory.

The next question is at what stage of the process the swelled grain should be produced. Making it on the dry print is not permissible, because the droplets are taken up too greedily by the dry film and diffuse quickly and irregularly. The safest method of working is to place the bleached and dried print in cold water until it becomes limp, then blot it off until quite dry on the surface, and then treat it.

The practical method of producing the swelled grain is as follows: the print, which has been swelled in cold water and thoroughly dried off, is placed on a horizontal support and the atomizer set in action; as soon as it works with complete uniformity, it is passed back and forth across the print as evenly as possible under continuous observation, until the whole print is uniformly covered with a layer of extremely fine drops. The most important precaution is the continuous observation of the print while the spraying is being done, and this is best done by having the light fall on the print at as small an angle as possible. The practical way to do this is as follows: the print is laid on a table near the window. The operator sits in front of the window and gets both his eye and the atomizer very slightly above and in front of the print. Under these conditions there is a reflection of light in every single drop, which

makes the observation of the distribution of the drops very easy. At the instant when the whole film seems to be uniformly covered with dew, the atomizer is quickly turned away from the print.

It is necessary to be thoroughly familiar with the action of the atomizer which is being used; with most atomizers the finest drops, on account of their lightness, fall downwards not very far from the mouthpiece, while others project their finest drops to a greater distance. The sprayed print, which naturally cannot be touched on the film side, must be left undisturbed for a certain period, which must be determined by experiment, for it depends, among other things, on the temperature of the room and the peculiarities of the paper which is used. An approximate idea may be had by considering these points: the longer the potassium carbonate solution lies on the print, the more the finest drops evaporate, while somewhat larger drops continue their action, so that the grain becomes coarser through longer action. A coarse grain can also be obtained by the use of coarse drops. If the drops are allowed to dry completely, the diffusion produced during this longer time results in an extra swelling of the whole film, without any grain effect.

After a sufficient time has elapsed, the potassium carbonate solution is removed from the film by rinsing or blotting off, and the print is swollen to the necessary degree. It is obvious that much lower temperatures must be used for this than if the print had not been treated with the graining solution, for the drops of the potassium carbonate solution cover a considerable fraction of the surface of the print. The fact that the greater portion of the surface of the print has been affected by

the spray makes it apparent that the alkaline solution cannot be replaced by a tanning solution, for the greater portion of the film would become less capable of swelling if such a solution were used, and therefore the latent tanned image would be destroyed. When the print is blotted off after swelling, it should show a scarcely visible relief when looked at by light falling from the side. The actual effect of the grain cannot be perceived until after the inking has been done.

The prints obtained in this way have, if the treatment has been successful, a very beautiful grained structure which extends over the lights and shadows quite evenly. It is possible to work on such a print quite normally without having to harmonize the degree of relief and the consistency of the ink with great accuracy. Especially is it possible to work up any given part of the print as long as desired with the brush without endangering the structure; on the contrary, it is improved by this treatment. For bromoil transfer, there are the following special advantages: every new transfer has exactly the same coarseness of grain, if this is imparted to the film once for all. In combination transfer, the grain persists in spite of the fact that several impressions are made on the same paper, because the swelled-grain elements are re-impressed in the same spots, if the registration is accurate.

Finally, it might be well to mention a few causes of failure which frequently occur in the first experiments. If the print appears to be covered with many small white spots at a certain distance apart but not in contact, the grain is too heavy and therefore does not take up enough ink. In this case, after rinsing, the print may be sprayed once more, carefully and not too heavily.



Larger white spots on the print show that when the grain was made large drops were produced by the atomizer. If such drops are noticed while spraying, the print should be immediately placed in water, dried off and sprayed again. If the print shows spots of rather large area which do not take ink and only show irregular ink spots here and there, it has been sprayed too long, that is, too much potash solution was applied, and the print is then useless as it cannot be corrected. In addition, such a print may be easily recognized after swelling, for a coarse grain pattern will be clearly visible on the film.

This swelled-grain process permits of very beautiful and characteristic results, yet, like all variations, it assumes a solid knowledge of the bromoil process, and must be practically used over and over again before it can be applied with certainty.

MIXING THE INKS. — As has already been mentioned, we have at our command for bromoil not only black and brown, but any other color of ink in various shades.

As a rule, however, colored inks are somewhat too bright to be used pure; moreover, as a rule they can only be had commercially in a fairly soft consistency. This is actually no disadvantage, as one is often forced by the consistency of the ink to do what is counselled by good taste, that is to tone down the colored ink with hard black ink. It is not practicable to make a mixture of hard black ink with the colored with the knife on the palette, because it is difficult to hit the exact shade with certainty in this way. It is better when using green, blue or any other colored ink *to mix the inks with the brush on the bromoil print itself*. First one should go over the whole print very delicately with hard black

ink and almost complete the drawing by hopping. Then the work should be continued as would be done if we were mixing hard and soft ink, merely replacing the soft black ink by the colored one. Then the work should be continued with the mixed ink; if the exact shade has not been hit, more or less of one or the other color is taken up by the brush until the desired color effect is obtained.

It is immaterial that those parts of the print on which one has tested the mixture show a little too bright or too dark a tone. By going over these again with the final correct color these places, though perhaps only after resoaking, will reach the proper tone, as the ink in the brush and that already on the print quickly mix to a uniform value.

If, in the course of the work, it appears that the mixture of this and the colored ink, the color tone adhere properly, it is not advisable to attempt further softening by the addition of soft black ink. By the mixture of this and the colored ink, the color tone already decided on will be altered. In such a case varnish or linseed oil must be used to soften the mixed ink.

POLYCHROME BROMOILS. — Prints of two or more colors have previously been made, aside from the three-color process printed from three-color separation negatives, chiefly by the gum-bichromate process, by coating the print successively in different colors. After each coating the negative was printed, usually with masks, and the unnecessary parts of each colored coating were washed away during development. The preparation of a polychrome gum print is extremely tedious and uncertain. Not the least of the difficulties is the fact that in

consequence of the addition of the chromate the color effect cannot be determined with accuracy until the print is finished and the chromium salts are removed. Moreover, as a rule the color layers are perfectly distinct and the color mixtures formed by their juxtaposition must be accepted as they happen to come. A correction of the colors during the work is not easily effected.

*The bromoil process, on the other hand, is in its very essence preëminently suitable for work in several colors, and offers all the possibilities which have previously been lacking. Without any special preliminary preparation the worker can apply any number of different colors to one and the same print at one sitting; he can harmonize them to each other during the progress of the work, combine neighboring colors by working them into each other on the print and easily correct any error that may occur.*

It is true that the execution of a bromoil print in polychrome requires complete mastery of the process; an indispensable condition is a perfect command of the handling of brush and ink. Therefore, experiments in polychrome bromoil printing can only be recommended to those who have the monochrome process absolutely at their fingers' tips.

If a negative is to be printed in several colors, the worker must first be absolutely clear as to his artistic scheme and know exactly in what color each individual part of the print must be executed; he must further be sure that the chosen colors harmonize with each other. He will not always be satisfied with the colors to be found in commerce, but must prepare the necessary inks for himself.



At first pictures should be chosen which contain large areas of uniform coloration, and as few colors as possible should be used. If you are not perfectly familiar with the print, it is necessary to have a proof as a guide, so as not to overstep the outlines of the different parts of the image which are to be individually colored.

The best way of setting to work is as follows: first select the color necessary for one or more of the larger areas of the picture, for instance green for the foliage, and work up these areas completely, until they have acquired the requisite vigor and detail. Such parts of the outlines as are adjacent to lighter, and hence more strongly swollen parts of the print, need be given no special attention, for color that does not belong on them may easily be removed again with the damp cloth, as previously mentioned. On the other hand it is well to work carefully with every outline which lies next to a darker part of the picture which is finally to be of another color. Here it is best not to apply the ink right up to the boundary, but to complete the inking with a small brush only after the adjacent parts are coated with their own color. If, however, such outlines are overstepped and the adjacent parts are colored with an ink that should not be applied to them, this should be removed with a very wet cloth, twisted to a fine point, by gentle rubbing. During this the print should remain on the pad. If the incorrectly inked portions are small in area the ink may be removed with art-gum.

When the first large areas are finished, the print should be again soaked in water, as it will probably have dried somewhat, then dried off, and another part of the picture dealt with, with a fresh color. If the adjacent

colors are properly chosen, the result, with objects which have no sharp outlines but merge into one another, will be that the adjacent parts will spontaneously blend into a harmonious transition of color. Parts of the picture which have the same basic color must not be done throughout in one and the same shade; thus large stretches of vegetation, which extend into the distance, should be executed in front in a yellowish green, and should be shaded back into a bluish green and insensibly into blue in the distance; such transitions can be effected without difficulty. If in the shadows there are small parts which require another color, they should be inked with a very bright color, which is then reduced by going over the whole surface at one time.

If it is found that a mistake has been made in any color, that part of the print may be cleared of ink as described on page 72, and the work repeated. If it should finally appear that individual colors are too glaring or that the whole color scheme is too harsh, it is possible to go over individual parts or the whole print with some suitable color, so that the colors already applied are improved by a slight admixture of this covering color.

Such a procedure shows most emphatically what advantages there are in the possibility of mixing and toning down the colors on the print itself. As a rule, to tone down too bright colors, these portions or even the whole print are gone over with black ink, but if necessary other colors may be used for the same purpose.

Thus, for instance, a picture in which there are brown roofs, yellowish-green foliage, a sky of a pronounced blue shade and water of another blue, can be made harmonious by going over the whole print very lightly

with the blue of the sky. Thus the vegetation will lose some of its yellowish tone, and all other colors, without losing their own characteristics, will acquire a certain unity. If the sky parts of a picture are swollen too much, their uniform inking is not easy. Then it is advisable to ink up the sky only on the dry print, as is suggested on page 112.

Because the tonality of any color, which has already been applied, can be altered with the brush, polychrome bromoil printing affords very great possibilities. Obviously good taste and a sound color sense are indispensable requisites, for without them there is danger of producing the undesirable effects characteristic of certain colored postcards. It may also be remarked that the colors, after defatting, have a somewhat less pronounced brilliancy, as they lose their gloss.

In polychrome bromoil printing, the choice of too small sizes is not to be recommended. The larger the picture is, the larger also are the areas which may be uniformly treated and, therefore, the easier it is to keep within the outlines.

Within the limits of this chapter, it is not possible to teach polychrome bromoil printing, only to outline its fundamentals. The unlimited freedom which it offers will certainly in the course of time produce many excesses in color. For this, however, we should condemn, not the process itself, but those who have abused it. In general it will be as well not to approach too closely the actual colors of the objects represented, but to work for the attainment of artistic effects. We must, however, in any case avoid even the most remote imitation of the painter; we cannot arrive at the solution of the problem of natural colors on paper by the polychrome bromoil process.



## CHAPTER IV

### AFTER-TREATMENT OF THE FINISHED PRINT

THE film of ink on the dried bromoil print after the completion of the brush work is as a rule not very tender, except where much soft ink lies on the surface. It is not advisable, however, to put the print under pressure, as for instance in a printing frame, for under strong pressure the ink may still partially offset on the adjacent paper, so that the image is damaged. No pressure should be applied until after the removal of the fatty medium, which is described later.

When the brush work is completed, the whole surface of the bromoil print shows a slight gloss, caused by the fatty medium of the ink. The shadows show a stronger sheen, especially in those places where there is more soft ink, for soft inks contain more medium. The surface of the print, so far as the gloss is concerned, is like that of a finished gum print. But with the latter the gloss cannot be removed; when it is desired to get rid of the unpleasant property of gum prints, that the shadows are more glossy than the rest of the print, it is necessary to make the whole print glossy by painting it with a solution of gum. This is also the case with the carbon process.

*With the bromoil process, on the other hand, it is easily possible to remove the gloss entirely. The shininess of a finished bromoil print is especially unpleasant*

when seen sideways, but, in certain cases, it imparts depth to the picture and may be made fairly inoffensive by glazing the print. Prints which are to keep their gloss must be exposed to the air for some days, protected from dust, until the ink has completely hardened. Until this has happened, the surface of the picture, especially where the ink is soft, is sensitive and ought not to be touched.

DEFATTING THE INK FILM. — Before removal of the fatty medium from the ink, *the print must be absolutely dried out*. It must be so dry that it rings sharply when the finger is snapped against it. Also, the dish in which the defatting is to be carried out must not contain the slightest trace of moisture, otherwise trouble will be caused.

An easily volatile solvent of the fat, such as benzol, trichlorethylene, carbon tetrachloride, etc., should be poured into the dish, and the print immersed in the liquid and allowed to remain for some minutes with constant rocking. On account of the danger of fire from the vapors of benzol, no naked flame should be allowed in the room. Carbon tetrachloride (carbona), on the other hand, is non-inflammable; its solvent action, and that of the trichlorethylene, on fats, is much more rapid than that of benzol.

The film of ink is, as a rule, not damaged by the solvent, though care should be taken with prints which have been executed wholly or mostly in soft ink. With such prints it may happen that the ink is entirely dissolved in parts, or that irregular sharp lines and streaks are suddenly formed. Soft ink prints should, therefore, be allowed to dry for several days before they are defatted. By the use of very energetic solvents, such, for instance,

as trichlorethylene and carbon tetrachloride, soft ink prints, as a rule, are completely dissolved. *Benzol is, therefore, to be preferred in all cases.*

The print should be removed from the liquid without touching the ink film, softened by the solvent. This evaporates fairly quickly, and *now the bromoil print has an absolutely matt surface of great beauty.* It is here naturally assumed that the fatty medium of the ink is soluble in benzol, which is usually the case.

*The solution of the medium from the fatty ink, besides the removal of the gloss, has also the effect of fixing the surface of the picture and making it more resistant.* While the film of ink before the defatting is fairly tender, it afterwards has a stability at least equal to that of a pencil drawing. The surface of the finished bromoil print is generally at least as little liable to damage as the film of prints prepared by other photographic methods. It seems as if the very minute grains of pigment contained in the fatty ink are made firmly adherent by the drying of the somewhat tacky gelatine film and therefore remain fixed even after the removal of the fatty medium. It is only from places in which a specially thick layer of soft ink was deposited, that a trifle of pigment dust can sometimes be removed by light friction.

*The defatting is therefore a procedure which is advisable in most cases and only after this is the bromoil print actually complete.* After it has been carried out, the image consists of pure mineral pigment adhering firmly to the gelatine. It is self-evident that a print treated in such a way is absolutely permanent, provided that the inks used are non-fading, which is almost always the case. One can also subsequently moisten or



soak the print without any danger if, for example, it is to be mounted on cardboard.

RETOUCHING THE PRINT.— The defatted bromoil print is susceptible to the most far-reaching mechanical modification. The picture now consists, as already mentioned, entirely of extremely fine particles of pigment adhering to the film about as strongly as the lines of a pencil drawing. *This pigment can also now be treated with rubber exactly like a pencil drawing. The ink, as far as it was put on by degrees, can also be removed by degrees from any desired place by proper measures.*

In the finished bromoil print the deepest shadows are formed by a comparatively thick layer of pigment, while the lights have only a very delicate coating of ink. We are consequently able to diminish the thickness of the film by proper treatment, removing it layer by layer, so that the shadows become more transparent, or the film of ink may be entirely removed, so that the gelatine base is laid bare.

The best tool for this is a piece of a hard rubber eraser sharpened to a fine point with sandpaper or a file. It is also advisable to use a very soft sharpened eraser for treating very light places.

Every part of the print which is to be lightened should now be gone over with the point of the rubber in fine lines very close together. The ink powder, which is taken up by the rubber, must be removed from time to time by rubbing the rubber on the sandpaper, or it will be left on the print again in the form of dark lines. If gentle rubbing with the eraser does not have the desired effect, it should be used more energetically. Sometimes the ink adheres so firmly that the rubber must be used quite vigorously in order to remove it. On the other

hand, where soft ink has been applied, one must work very lightly, or more ink may be removed than is desired.

*Important details of the picture may be completely taken out with the rubber* without getting down to the paper, if the work is done carefully. Thus, for instance, unsharp figures in the foreground of a street scene, disturbing details in the background of a portrait, undesirable details of a landscape, such as telegraph wires, ugly poles, trees, etc., may be removed almost without leaving a trace behind. If this treatment does leave visible marks, they can be easily made to disappear with brush and ink.

For removing or lightening tiny spots or lines, or for removing brush hairs and similar imperfections left during the inking, one may use a sharp *lancet or penknife*, or a steel needle set in a handle. Yet in the use of these sharp instruments one must be careful to scrape the surface very gently and carefully, or the gelatine film may be cut, which leaves noticeable marks.

The possibility of removing the ink from the finished print in layers by the use of an eraser, without leaving any trace, gives the bromoil printer another means for modifying the tone values of the print at will. If preconceived ideas were not fully carried out in the application of the ink, because tiny places could not be properly worked out with the brush, or because they were overlooked, the desired change of tone values can now be effected; with the aid of the rubber, also, *especially effective lights* may be added to the picture.

*If, in the application of the ink, large areas were not quite uniformly treated, they can be corrected now without trouble. Dark spots of ink can be easily removed*

*with the rubber, and it is often easier to even out a rather broken surface with the eraser than with the oil-printing brush.*

Bare spots, white points, and other defects of the image, or places from which too much ink has been removed with the eraser or penknife, are best spotted with *water-color* of proper shade, or in the case of brownish-black prints, even with charcoal. The defatted film takes the water-color easily and places treated with it remain perfectly matt; on the other hand, *retouching with lead pencil should be avoided whenever possible*, as this always produces a certain shininess, which is rendered particularly prominent by the dull surface of the rest of the print. A bromoil print which has not been defatted may also be retouched in the same way, but the parts worked up with the rubber are then noticeable. Filling up spots on such prints is best effected with oil-printing ink, applied with a water-color brush dipped in heavy benzol so as to dilute it.

It is thus possible in the bromoil process to produce very comprehensive changes with rubber, needle and ink, without destroying the character of the picture. With some experience this work is done so quickly and easily that it is not necessary to retouch the negative at all, even with portraits. The removal of imperfections in the complexion or the softening of too sharp features can be effected much more quickly and with more certainty as to the effect on the finished bromoil print than on the negative, especially as retouching on the negative shows up unpleasantly in enlarging.

The possibilities of after-treatment of a bromoil print are manifold. Thus, for instance, by means of the eraser very natural appearing clouds can be rubbed into



the cloudless sky of a landscape not taken with an orthochromatic plate, if in inking the sky is properly darkened. In the background and subordinate planes of a portrait, a certain draughtsmanlike character can be attained by suitable delicate strokes with the rubber. Ugly lines of the hair or clothing which could not be suitably dealt with in the inking-up, can now be altered with a little skill. A dull landscape may be made more lively by picking out a few lights.

Finally, it may be mentioned that it is also possible *to change the color of the paper base of the print*, though this is best done before the application of the ink. Commercial bromide papers as a rule are only obtainable in white or yellowish tints. Another tone may be imparted to the paper, for instance reddish or bluish for certain effects; this is effected by swelling the bleached and fixed bromoil print in a dye solution which has been found suitable by preliminary trial with white paper. The paper fibers and the gelatine assume the desired color and the print after soaking is removed and worked up as usual; this staining may also be done with finished prints.

REFATTING OF THE PRINT. — As already mentioned, the finished bromoil print shows on its surface places with different degrees of gloss, since the parts of the picture which took a good deal of ink, as for instance the shadows, are more shiny than the rest. In order to remove these sometimes unpleasant effects, the finished bromoil print can be immersed in a fat solvent, which completely removes the glossy medium from the ink film. After the evaporation of the solvent the bromoil print has a perfectly matt surface.

Frequently, however, this complete dullness of the

surface does not please the worker, because, especially with soft ink prints, it causes a marked *loss of brilliancy*. It is thus necessary to choose between a brilliant surface with unequally glossy places, or a uniform matt surface. I have undertaken experiments to place in the hands of the bromoil printer a means of imparting to his prints any desired degree of gloss, after removal of the unpleasant uneven shininess. Attempts to obtain brilliancy by the use of ordinary varnishes failed. Whether the varnish was sprayed on or the print was immersed, there was always a certain damage to the surface, since the ink film, which lies rather loosely in the form of powder on the defatted soft ink prints, combined irregularly with the varnish and caused some trouble. I was finally successful with the following plan, which is a logical consequence of the nature of the bromoil print and the varnish inks used in making it.

Dissolve from 5 to 10 ccm of linseed oil varnish in 500 ccm of benzol (77 to 154 minims to 16 oz.). Then the defatted and perfectly flat print is completely immersed in this solution for one minute and hung up to dry. Perfect flatness of the print is necessary, otherwise troublesome markings are formed in drying, which, however, may be removed without difficulty by repeating the process. Irregularities may also be caused by supporting the print by the fingers on the back before hanging it up; the warmth of the fingers evaporates the solvent more quickly, so that spots are caused. The print should only be handled by the edges until it is dry.

After the evaporation of the solvent, the linseed oil varnish dissolved therein is very evenly distributed throughout the whole film of ink; this restores to the ink a part of its varnish which was removed in the de-

fatting, but more evenly distributed, so that now the whole print shows a gloss, which is hardly noticeable, but which considerably increases the brilliancy. If this gloss is not sufficient, more varnish should be added to the bath; if it is too strong, more of the solvent is added. In this way any degree of gloss desired can be obtained. If it is too strong, it can be removed again with benzol. When the bromoil print is to be retouched it should be defatted before retouching and afterward treated as just described, so that the varnish bath may also act on the retouched places.

If no retouching is required, then the defatting can be effected in the varnish bath, which then effects a kind of equalization, since the shadows rich in varnish give up the medium, while the other parts of the picture take it up.

By the use of weak varnish baths for after treatment of defatted bromoil prints, surfaces of velvety appearance may be obtained.

APPLICATION OF INK TO DRY PRINTS.—When the gelatine film has been swollen to the highest possible relief even the very soft inks take only with difficulty and in consequence frequently irregularly. Sometimes the formation of such places is unavoidable, especially when prints with very great contrasts have to be used. We are then forced to choose a relief which permits the inking of the darkest parts of the print. The warm water, or ammonia, bath requisite for this acts so strongly on the slightly tanned or untanned parts, that an excessive relief is obtained, and then the ink takes with difficulty or not at all. This most frequently happens with skies which are very dense in the negative.

Such parts of the print, resistant while it is wet, can,



however, be inked up without difficulty after the print has been allowed to dry. Then they are inked up with a brush, using an ink of the same tint and consistency as was used in making the bromoil print itself. The dry gelatine takes the ink quite evenly, and in this way any desired tone from the most delicate to the darkest may be obtained. By omitting to ink in suitable places, clouds may be imitated, and if necessary these may be worked up by retouching.

With polychrome bromoils, when the skies are too swollen, one should carefully remove all areas of ink which project from the landscape into the sky, and this is also advisable in monochrome work. The best thing to use for this, especially with complicated outlines, is a water-color brush dipped in two per cent solution of ammonia, which easily removes the obtrusive ink from the gelatine. Larger areas should be carefully rubbed with a point of wet linen or with the finger tip wrapped in a wet cloth. In this way the highly swollen parts of the gelatine are completely freed from ink; then the print should be dried and the sky inked up as desired in the manner described above.

The method of applying the ink to the dry film is valuable for obtaining other effects, as is more fully described in the next chapter, on bromoil transfer.

In bromoil, photographic printing has been enriched by a process that can fulfil every wish of the photographer who is striving for artistic results. It combines in itself all the advantages of previously known processes, but surpasses them all in the possibility of general and local control, and especially in the fact that control can be effected at will at any desired step of the process from the beginning to the end, that it need not

extend over the whole print but may be limited to particular parts, and that the results of the control are visible immediately, during the work. Not the least important, however, is the fact that the flexibility of the process enables one to immediately repair any error without impairment of the print. When it is further considered that the bromoil process is independent of the size of the negative, that it permits the operator to use any support, any structure, any grain and any color, we should be warranted in saying that the bromoil process is the process of the future for amateurs striving for artistic results.

## CHAPTER V

### TRANSFER METHODS

**S**IMPLE TRANSFER.—Bromoil prints, which have been inked up but not defatted, can be effectively used as print-plates, from which pulls on any desired plain paper can be taken. The process of making such transfers is simple and certain and opens a whole series of new possibilities to the amateur. Briefly the method is as follows:

The greasy ink on a finished bromoil print lies on a gelatine film. If the inked print is brought into contact with any uncoated paper and passed between two rolls under pressure, the ink transfers from the bromoil print to the paper. Obviously the picture thus produced is laterally reversed, which must be kept in view in preparing bromoil prints for transfer. Bromide enlargements to be used for transfer should, therefore, be made reversed.

The bromoil print can again be inked up after this process and again used for transfer; with bromide papers with resistant gelatine films this process may be repeated many times.

The advantages which bromoil transfer offers are as follows: in the first place we attain the end so often sought of being able to use any suitable paper for making photographic prints, which opens a new field for artistic endeavor. Obviously, also, any desirable oil-printing ink can be used, so that the whole gamut of colors is at the command of the operator.



The personal control of the tone values of the print, which attains its maximum development in bromoil printing, is equally possible in bromoil transfer.

The picture is obtained on an uncoated paper and, therefore, the prints are of a character which hitherto could scarcely be obtained.

The finished prints, if the paper is properly chosen, can be retouched as much as desired.

From a single bromoil print a whole series of impressions can be obtained, which may either be all alike or quite different. They can be made heavy or light, in one or more colors, or even in polychrome, according to how the re-inking is done.

The transfer process is also very cheap, as the papers used are naturally much cheaper than photographic printing papers. Moreover, one can make the pulls from small bromoil prints on larger sheets, so that the picture may be suitably surrounded with white margins.

The following details should be observed in the preparation of bromoil transfers:

The bromoil print designed to be used as a print-plate can be made on papers of the characters described in Chapter I, page 13. The bromide paper need not necessarily be free from structure, for with the pressure to which the sheet is subjected in the transfer, the effect of the structure is lost. The structure of the bromide paper may also be reduced by passing the bleached print through the rollers of the transfer machine under heavy pressure before inking. *The bromide print or enlargement must be kept very clean and free from fog*, since the cleanness of the high lights plays a very important part in the transfer. The inking is done in the usual way; only one should use all possible means to obtain

the greatest possible cleanness of the high lights, and good modulation. After inking-up, any brush hairs and especially any little particles of ink that are not broken up must be removed, as the latter are especially troublesome in the transfer.

The process succeeds best when the bromoil print has as high a relief as possible. Such a relief facilitates and requires the use of inks of soft consistency; soft inks adhere to the gelatine film far less firmly than harder ones and, therefore, transfer very much more easily to the transfer paper. A simple experiment makes this fact very clear: if the tip of the finger is placed on a part of the bromoil print worked-up with hard ink, some of the ink sticks to the finger, but at the most there is formed on the print an impression of the tip of the finger, as the place touched still retains the greater part of its ink. If, however, the tip of the finger is placed on a part of the print worked up with soft ink, the latter will be almost entirely removed. This may serve to show why bromoil prints which have been entirely or chiefly worked up with hard ink cannot be entirely transferred to the transfer paper. The shadows especially, when covered with hard ink, are likely to appear much reticulated in consequence of the imperfect transfer of the ink.

*To obtain with certainty a faultless bromoil transfer, soft ink should therefore be used;* the softening of the ink must naturally not exceed a certain limit, because otherwise the high lights will take the ink and a clean pull cannot be obtained. In order to be able to use a soft ink successfully, the relief of the bromoil print must as a rule be kept rather high; hence usually water baths of suitably high temperature should be

used. It may, however, happen, especially with contrasty prints, that the gelatine in the high lights becomes too soft, and if it is not already damaged when taken from the warm water, it pulls off in inking-up or in the transfer. In order to avoid this, it is best to use the ammonia bath described on page 45.

Bromoil prints which are to be used for transfer must, as already mentioned, always be kept very clean. This is necessary for the following reasons. In the transfer the ink on the high lights transfers completely in every case to the transfer paper, for the high lights are in the highest relief, and the ink adheres to them very lightly. On the other hand the ink is generally not completely removed from the shadows, as they have the lowest relief and, in consequence of their tanning, the ink adheres to them more tenaciously. Thus it happens that the transfer is usually somewhat shorter in gradation than the original bromoil. Allowance must be made for this, and the bromoil print should be made considerably more brilliant than the transfer ought to be, unless low-toned transfers are intentionally sought.

In order to obtain clean, sharp edges the bromide print when dry should be cut to the desired size and a small tab of paper left at one corner, which is useful for hanging it up in the further processes, whereby any damage to the film of the picture itself is avoided. This little tab should be cut off just before inking. If a plate mark is desired, the print should be made with a suitable narrow white margin.

The finished bromoil print can be immediately used for the transfer. If it is not used at once, it remains fit for transfer until the ink begins to harden.

Any desired kind of paper may theoretically be used



for the transfer; but obviously, the success of the transfer greatly depends on the choice of the paper. The finest effects are obtained on matt and absorbent, but strong and well-made papers, the very best being papers intended for copper-plate printing. As the ink penetrates into the fiber of such papers to a certain extent, they give beautiful transfers with an absolutely matt surface. Absorbent papers also make it possible to transfer almost all of the ink from the bromoil. It is different with sized or highly calendered papers. With these, the ink only penetrates a very little way because of the film of size. The ink, therefore, lies chiefly on the surface of the transfer and appears glossy in the shadows; also, as it is not sufficiently absorbed by the transfer paper, the transfer of the ink from the bromoil to the paper is usually not complete.

It is advisable, when using calendered paper, to remove the gloss by preliminary dipping in water. Other kinds of paper also frequently give better transfers, if they are first moistened; this is most easily done by dipping them in water and then drying them between two blotters.

Papers which are inclined to blister because of short fibers easily split in transfer, as parts of the surface of the paper adhere to the high lights of the print and tear away.

Such papers may be made available for transfer, if they are coated with two per cent wheat starch paste and allowed to dry (Process of E. Guttmann). This is prepared by stirring up 2 g (60 gr.) of wheat starch in a little cold water, and adding to the mixture 100 ccm (3½ oz.) of actually boiling water, stirring well and allowing to cool.

The blistering of weak papers must be differentiated from the sticking to the transfer paper of parts which are too much swollen; in this case the surface of the paper remains undamaged, but the gelatine film of the high lights is torn off and adheres to the transfer paper. As a rule, this only occurs with those parts that are swollen too much, when too great pressure is used in the transfer. The preliminary sizing of the transfer paper with wheat starch prevents this also. Parts of the gelatine film which have high relief may also be protected from sticking to the transfer paper by a slight coat of varnish.

The best machine to use is that described by E. Guttmann on page 153. It has proved satisfactory in every way, especially as it permits accurate and easy regulation of the pressure of the rolls. If such a press is not available, an ordinary burnisher can be used. The simultaneous movement of the rolls in burnishers is produced as a rule by two gear wheels. The inaccurate fitting of the gear teeth, however, causes periodic irregularities in the pressure, which cause trouble in the transfer. In order to prevent this one of the gear wheels should be removed, so that the simultaneous movement of the rolls is produced by the pressure alone. A burnisher is useful for the preparation of transfers only if it is possible to obtain sufficient pressure on the rolls. On the other hand it is difficult to obtain with this machine the necessary regulation of the pressure during the transfer, which is described in the following paragraph.

The following is the procedure in transferring. A blanket must first be interposed between the rolls of the press. The best thing to use for this is two or four thin smooth cards, which may be covered at top and

underneath with two sheets of thin linoleum. The latter are not absolutely necessary. The print may now be introduced into the machine either by entirely removing the blankets, or by rolling them out far enough so that the middle sheets can be easily bent away from one another. The position of the transfer on the transfer paper should be marked with a pencil, and, if a plate mark is desired, a piece of cardboard cut to the proper size should be properly placed on the transfer paper, and the whole passed through the machine. The transfer paper, thus prepared, should be laid on a perfectly flat white blotter, and the bromoil print, which should be held very carefully by the extreme edges, should be lowered to the position on the transfer paper previously marked with the pencil. Any small ink marks thus caused can be easily worked out later. The back of the print should be dried with a white blotter and then a second sheet of the same size as the bottom one placed on it. The transfer paper with the print lying on it is thus placed between the two sheets of blotting paper, so that the water pressed out in the transfer may be readily absorbed.

If attention is not paid to this precaution, it may easily happen that the transfer paper, as a result of partial moistening by means of water pressed out of the bromoil, may become wrinkled or distorted. Then the two blotters, with the transfer and the print between them, are placed between the two middle cards and the transfer begun. The principle of gradually increasing the pressure in this, which was introduced by E. Guttman, has proved satisfactory in practice. One begins first with a light pressure, so that the transfer passes through the rolls with scarcely noticeable resistance.



Then the pressure should be increased a little by tightening the upper wheel of the machine, and the work continued in this way until a certain, not very high pressure of the rolls is obtained, which one soon learns to estimate with a little experience. One can now, or at any later stage, take the transfer paper with the adhering print out of the press and, holding one part of the print firmly down on the transfer paper, with the hand or a straight edge, lift the free end carefully, in order to ascertain whether any and how much of the ink has been transferred from the print to the transfer paper.

According to the result of this observation, the print is either entirely lifted off or the transfer continued with increasing pressure. In this way, with careful management of the work, one is absolutely certain of obtaining the best possible results in transferring. Still, my opinion differs from that of the inventor as to the reason for the satisfactory action of the gradual increase of the pressure. What happens is that in the initial passage under low pressure the print is immediately firmly attached to the transfer paper, so that its shifting on the transfer paper, which previously very frequently occurred, is avoided. When this adherence is once attained, we can proceed at once to that pressure of the rolls which is the most favorable for the transfer of the ink, if we are sure of it. This frequently happens when one has already made transfers from a print. With still unknown conditions, naturally the gradual increase of pressure is advisable.

The print, removed after the completion of the transfer, can be again inked up immediately or later, and again transferred. Naturally it must first be immersed in water, so that it can again take up that which it has

lost in the transfer. In the new inking-up one can use as desired the same ink or another color, and also alter the print as seems best. If the bromoil print, which has been once used for transfer, is to be again used for the same purpose, it is well to completely remove any adherent traces of ink by going over it with a swab of cotton soaked in a solvent. It may then be dried and can be used again at any desired time.

When transfers have been repeatedly made from a bromoil print, it may happen that the film blisters. This phenomenon is usually only noticeable when the print is again immersed in water after the transfer; as long as the blisters are not too numerous, they do not cause much trouble in the transfer. The answer to the question as to how often a bromoil print can be transferred depends on the resistance of the gelatine film. In practice it has been observed that the number of possible transfers varies between five and twenty-five.

The transfer process can also be used in bromoil printing as a method to free a print that has been too heavily inked from the excess of ink; such a print is passed through the machine together with any completely smooth paper which is free from folds, until it has given up its excess of ink to the paper, and it can then be soaked and inked up anew.

The process of application of ink to the dry print, outlined in Chapter IV, can also be used to advantage in the transfer process. Any bare spots on the finished transfer can be inked up at will, by dabbing on ink of any tone value with the oil-printing brush; thus the sky, which may not be satisfactory, may before transfer be wiped quite clean on the print, the outlines of the landscape cleared up with a brush dipped in ammonia

water if necessary, and the values of the sky put in on the finished transfer. This procedure is particularly advisable in polychrome transfers, with which a blue sky flecked with clouds can be easily obtained in this way.

The subsequent application of ink to the finished transfer finally offers the possibility, by tinting the whole transfer with a very delicate coating of a suitably chosen ink, of imparting a different mood to the picture. Thus, for instance, one may give a transfer made on white paper a faint yellowish tint; it may be effective to surround the picture with a border of this tint, using a suitable mask to obtain sharp outlines; this yellowish tint is only visible in the high lights, as it does not show in the deep shadows. In similar fashion a darker tint surrounding the print may be put on with ink and brush.

It is obvious that the transfer, especially when fresh from the press, can be easily and thoroughly retouched with rubber, water-color or charcoal; first of all those places should be treated from which the ink has been removed in consequence of the unavoidable touching of the print with the fingers, or to which the ink has not transferred for any reason. With transfers fresh from the press, any places that are too dark can be easily lightened with the rubber.

The transfer very soon dries. Obviously it does not require defatting. The inks act better on the absorbent transfer paper than on the bromoil print itself, as they sink into the paper instead of remaining on the surface of a gelatine film. The final result no longer resembles a bromoil print, but has its own individual character and is a product which it is difficult to compare with the bromoil print as regards esthetic effect. The bromoil



print has a certain charm which is lacking in the transfer and vice versa. In any case the transfer process is worth attention, since on the one hand it can be of practical value because of the possibility of the duplication of bromoil prints, and on the other hand it enables one to use varieties of paper which were not hitherto available to the amateur.

COMBINATION TRANSFER.—In order to render possible the reproduction of every possible tonal value of the negative, I have worked out the *combination transfer process* outlined in the following paragraphs. The essence of this process lies in the fact that two or more transfers can be made on one transfer sheet, which differ so much in their quality that *each of them reproduces a different series of tone values*, which then supplement one another on the transfer.

This is attained either by executing the two superposable transfers with *inks of different consistency*, or by *the use of two prints of different gradation* to make one transfer.

COMBINATION TRANSFER WITH ONE PRINT-PLATE.—The bromoil print used as the print-plate must be made on a sheet of bromide paper, which reproduces the tone values of the negative as closely as possible, without showing any hardness. The lights must be clean and all the half-tones present; it is, however, neither necessary nor desirable that the shadows should be too dense. In making the bromide print from a moderately difficult negative one should use the process, outlined on page 23, or developing slightly and then completing the development in a dish of water. Bromide prints of this kind are necessary because they satisfy the most rigorous requirements in the high lights and half-tones,

while the depth lacking in the shadows is produced by the repeated transfer.

On the print thus prepared two bromoil prints, differing entirely from each other in character, are made, one of which we will call the *shadow print* (Kraftdruck) and the other the *high light print* (Lasurdruck). This phraseology does not coincide, however, with the similarly named terms which are familiar in gum printing; the middle-tone print usual in gum-printing is wanting here and is also unnecessary, since each of the two partial prints contains a part of the middle tones, and, therefore, when added together, they give a picture perfectly correct in tone.

The *shadow print* is executed by inking up with a stiff ink, so adjusted to the relief that only the deep shadows and a part of the half-tones take the ink, while the delicate half-tones are lost and the highest lights remain absolutely uninked. Having suitably adjusted the ink to the relief, one should also use the corresponding brush technique, which was described as hard ink technique on page 87. The use of a hog's hair brush is advisable. Perfect cleanness of the high lights, which is very important, should be assured by the use of art gum. The shadows must show the full drawing, but ought not to be overinked. This shadow print should now be transferred to the transfer paper; when it leaves the press, the *registration marks* must be immediately applied, so that the subsequent transfer may come exactly in the same place. It may be remarked, that the matching of the print to the transfer does not offer the slightest difficulty in practice, and that the registration marks can often be omitted entirely, especially with prints which are inked right up to their edges, because bro-

moils, in making which rather thick paper is used, leave a fairly strong impression on the transfer paper, into which one can fit the print in the subsequent transfer.

At the same time it is safe to use the following simple registration arrangement in every case.

When the transfer is taken from the press, draw, by means of a rule, two parallel lines perpendicular to the side edges of the print, running over onto the transfer paper about one centimeter or one-half an inch apart. Also draw with the rule a line perpendicular to the upper surface of the print, also running over onto the transfer paper. In preparing for the next partial print, the side lines are first to be brought into exact coincidence and then the upper line. This insures exact coincidence for the subsequent prints.

After transfer of the shadow print, the bromoil is again immersed in water, in which it must remain for some time, so that it again becomes saturated with water. Only then does it regain the same size as it had at first, for the expansion caused by the absorption of water is quite considerable. If the bromoil is not left long enough in the water before the second printing, it will be slightly smaller than in the first transfer and the combination print will not be sharp.

**HIGH LIGHT PRINT.**—The inking up of the high light print is effected with soft ink, so as to produce a very thin and smooth film of ink; yet here too the high lights must be kept as clean as possible. Then this high light print is transferred by means of the above described registration arrangement, when as a rule the combination transfer is finished.

It may happen that one has inked up one or other of



the prints too lightly. In this case either the shadow or the high light print may be repeated, but the amount of ink applied for this supplementary impression must be very carefully judged, in order to avoid an overinking of the combination transfer. By the manner of inking the constituent prints and judgment in the quantity of ink applied, the final result may be controlled through a wide range at will; one can, for instance, by emphasizing the shadow print rather than the high light print, get more contrasty effects, or, by emphasizing the high light print, end with very soft effects.

The order in which the two prints are transferred is immaterial. In any case, however, care must be taken that the transfer paper is well dried out after making the first transfer; for it always takes up some moisture in the press and then appears slightly wrinkled and distorted. If the second transfer is made on such a damp transfer paper, the result will obviously be complete or partial want of sharpness in the combination transfer. After the first transfer, therefore, the transfer paper should be hung up to dry spontaneously, not by heat, as otherwise it may alter in size.

The process just outlined for combination transfer from a single print will in most cases perfectly reproduce the tone values of an ordinary negative. If negatives with a very long gradation have to be dealt with, then the following process may be used.

COMBINATION TRANSFER FROM TWO PRINTS. — The underlying idea in using two prints is to overcome the impossibility of completely reproducing an extended scale of tones on bromide paper, by the use of two prints, which are so made that they divide the scale of tones in such a way that one end of the scale is repre-

sented by one print and the other end by the other.

Therefore we make from the negative one hard print with well modulated shadows and only the darker half-tones. This is obtained by short exposure and suitable development. The high lights should show no deposit of silver. When master of the process, it is possible to include more or less of the middle half-tones in this partial print which is intended for the shadow print, according to the final result desired, and this can be readily regulated by the length of the exposure. The fewer middle tones the shadow print contains, the more contrasty will be the combination transfer.

The second partial print is the high light print, and must, therefore, be kept as delicate and soft as possible, and include all the delicate middle tones up to the highest lights. The latter may even be very slightly veiled, yet only so far that after swelling absolutely pure whites can be obtained. No further demonstration is needed to prove that a combination of these two partial prints can include the whole scale of tone values of the longest-scaled negative; for the partial print destined for the high light print-plate gives every possible half-tone, while the other, intended for the shadow print, imparts full depth to the shadows without burying the details, and strengthens the half-tones, but does not affect the clearness of the high lights.

The combination transfer is now prepared from these two prints, which are transferred in succession to the transfer paper, the order being immaterial. For this an accurate superposition of the two partial prints is absolutely essential. This must be accomplished by making the two prints of exactly the same size, with the images in exactly the same position on the paper.

This may be done by masking the negative with black lantern-slide strips gummed on the film for contact prints and on the glass for enlargements. The strips must be absolutely straight and the slightest curvature avoided in sticking them down. Two prints or enlargements, prepared from such a negative, can easily be registered. The desired end may also be obtained by printing or enlarging the two bromide prints under the same straight-edged mask. Care must be taken here that the image occupies exactly the same place in the mask for both prints. This is easily accomplished with various commercial printing machines. In enlarging, a mask made of stiff card can be hinged to the easel. The prints or enlargements thus made should be very carefully trimmed along the white margins and the difference in size ought not to exceed one-tenth of a millimeter (one two-hundred-fiftieth of an inch). Further, as different papers have different degrees of expansion, it is necessary to use the same kind of paper for the two partial prints, and it is best to take it from the same packet. It is also necessary to make both prints in the same direction of the paper fibers, for the expansion is different with and across the run of the paper.

One of the partial prints is transferred just as in the previous method. The registration marks are also made as was previously described, only the pencil marks must be placed exactly at the same points on the two partial prints, which can be done by exact measurement. With this process, also, the registration is not difficult in practice and the careful worker will find that the impression in the transfer paper caused by the first partial print, supplemented by the two lines on the edges, is sufficient.

The inking up of the two partial prints is effected



in the same way as was outlined for the process with one print-plate.

Both variants of combination transfer offer operators with a little dexterity a wide range of possibilities. By suitable treatment of the partial prints the tone gradations can be controlled at will. The resultant transfer will be softer or harder, as the shadow or the high light print predominates; it is possible to omit certain portions in either of the prints or subsequently print in more deeply any parts which need special strengthening; the two prints may also be executed in different shades of ink, with suitable discretion, and double tones thus obtained. It is also possible to print in clouds from a separate negative. Combination transfer is also well suited for polychrome transfers, since it renders possible the overlaying of a delicate black impression with different color tones. Again, since all the possibilities of control offered by the bromoil process are available, an almost unlimited new field of activity is given by combination transfer.

Finally, there is still another field in which the combination transfer allows remarkable effects. If one has a negative with excessive contrasts, as for instance, a dark arch with a vista of a sunny landscape, a satisfactory print can be made without difficulty by means of combination transfer. One partial print should be so made that it reproduces as correctly as possible the details of the dark part of the negative, in this case the arch, irrespective of the fact that the sunny landscape will be partly underexposed. Another partial print is then exposed for the sunny landscape, when naturally the details of the arch are completely lost. One may even go further still, since the two partial prints may be

prepared from two negatives taken from the same standpoint, the one being exposed for the high lights and the other for the shadows. A combination transfer, correctly executed from two such partial prints, gives a result in which both the darker and the lighter parts of the negative are reproduced in suitable tone values. It may also be mentioned that multiple transfer renders it possible to apply plenty of ink to calendered and, therefore, non-absorbent papers, and thus permits of the attainment of deep shadows, full of detail, on such papers.

In the various kinds of multiple transfer here outlined principles have been introduced into the transfer process which have been used in the gum-bichromate process and many graphic reproduction processes, in order to produce wide ranges of tone values by several printings on one print. Yet the means of attaining this end are novel, namely, either different consistency of inks with one print-plate, or the use of two different print-plates for one transfer.

In my first publications on such combination transfer processes, I mentioned still a third possibility of obtaining the desired end, namely the preparation of two partial transfers from one print by using two different degrees of relief. The process first outlined, using different consistencies of ink with one print, is, however, to be preferred to the process in which two reliefs are used, wherefore the latter was not further proceeded with.

The value of the transfer process has been so increased by the methods just outlined that it is capable of solving the most difficult photographic problem, and by its aid even negatives can be printed, which cannot be satisfactorily rendered even in bromoil. While hitherto the

transfer process was only an offshoot of the bromoil process it is, since the introduction of combination transfer, at least as valuable and in many cases even surpasses it.



## CHAPTER VI

### OIL *vs.* BROMOIL

**O**IL PRINTING AND BROMOIL PRINTING. — Oil printing and bromoil printing are frequently considered as two different photographic processes. From this premise different conclusions have been drawn, thus for instance, that oil printing is more suitable for certain subjects and that bromoil printing is to be preferred for other purposes. There has also been discussion as to which of the two processes deserves the preference, which produces the finer artistic effects, and so on.

All these discussions are, however, superfluous, for the assumptions on which they are based are erroneous. Oil printing and bromoil printing are actually not two essentially different techniques. In both cases there is one and the same process; *oil and bromoil printing are basically identical*. This can be proved both theoretically and practically.

*The theoretical considerations* are as follows: in most photographic processes the chemical property of certain substances of being changed by action of light is used for the production of the final image. Such photochemical processes only play a preparatory rôle in oil and bromoil printing. The production of the final image is here based on a physical property of the gelatine, namely on its innate possibility of being tanned or hardened. In oil and bromoil printing an image is first formed in the gelatine photochemically. This image is, however, not the final one; it is merely a means to an

end. Its actual purpose is the attainment of a suitable tanning of the gelatine. The photochemically produced image is therefore removed, but in such a way that simultaneously with the elimination of the image, the gelatine which carried it is proportionately tanned in the lights and shadows of the picture. Only by this tanning is the gelatine made ready for the production of the final picture. The purpose of these preliminary steps is the production of the tanned image in the gelatine, which by itself is invisible or scarcely visible. After carrying out the preliminary processes the result is a pure gelatine film, which shows places of greater and lesser tanning corresponding to the photochemical image which has disappeared and which, therefore, has greater or lesser capacity for swelling in these places. If at this stage there are still chemicals in the film they are of no value for the further processes.

If a gelatine film thus prepared is swollen in water, the untanned places suck up water, while the tanned parts do not take it up. Fatty inks, applied with suitable brushes, are then repelled by those parts of the gelatine which hold the water, while the tanned parts of the film freely take the greasy ink. The final image, therefore, is not formed until the inking-up of the film with greasy inks.

*This technique may, therefore, be most suitably characterized by the name "inking-up process." The usual names oil print and bromoil print merely designate, although in terms which are terminologically unsatisfactory, two methods of preparing the base for the inking-up process.*

Oil and bromoil printing are, therefore, nothing more than the two methods which have hitherto been at our

disposal for the production of a tanned image in gelatine.

Both methods lead to the same result; only the bromoil method is by far the more complete technically, as is shown in the following discussion.

In oil printing, printing is effected direct on a bichromated gelatine film. The chromate image is only faintly visible and is not easy to judge. From its nature it has a very short scale of tones and, therefore, only gives satisfactory prints from soft harmonious negatives, while with more contrasty negatives it must inevitably fail; if with such negatives the high lights are correctly printed, the shadows have long lost all details; if the shadows are correctly exposed, the high lights are wanting in detail. Control of the chromate image is only possible to a very moderate extent. This chromate image is washed out and leaves behind as a result the tanned image in the gelatine, in which all the disadvantages of the short scale of tones are inherent, and which besides this can be far less easily inked-up than a tanned image prepared by the bromoil method.

The process of bromoil printing has been fully explained in this book; a direct comparison of the two processes will be made very briefly. A correct print is prepared on a suitable bromide paper, either by contact or enlargement. Through the possibility of using direct enlargement, the enlarged negative, necessary in oil printing, is done away with. The bromoil image, in contradistinction to the chromate image is visible, and can be controlled in the most varied ways to attain the desired artistic effect. It has a much greater scale of tones than the chromate image; and this can in addition be increased in the subsequent processes far beyond the possible gradation of the bromide print. The



resulting bromide image is then removed by a bleaching solution containing bichromate, and in this way the tanned image is formed in the gelatine.

*Oil printing and bromoil printing, therefore, lead to the same result; but the tanned image, obtained by way of the bromoil print, is qualitatively of much greater value, for it has a much better gradation.*

The opinion is frequently expressed that it is a specific property of the oil print to give pictures of a peculiarly artistic character.

It is, however, absolutely erroneous to assume that the same effect cannot be obtained in a bromoil print. As already mentioned, the tanned images produced in the two methods are alike, but the bromoil print may have a far longer scale of tones.

The rich gradation of the bromoil print is however not present from the beginning, but is only produced by allowing it to swell in water of suitable temperature. The warmer the water used, the longer is the scale of tones, naturally within definite limits.

*In bromoil printing it is therefore entirely at the choice of the operator whether he will or will not make use of the long scale of tones which the process can give.*

If cold water is used for the soaking, the gradation of the tanned image is much less than that of the oil print or the bromide image. *By the choice of a suitable temperature of the water, the short gradation of the oil print with all its peculiarities can be exactly obtained.* With higher temperatures the gradation may be finally increased far beyond that of the original bromide image.

If one knows and has mastered the properties of the tanned image produced by the bromoil print, one may easily obtain the same effects as with oil printing; one

can, on the other hand, obtain incomparably more than with the latter. No limitation is imposed on artistic aims by the imperfection of the tanned image.

The following shows the *practical comparison* of the two methods: if we have before us prints with gelatine films which contain tanned images, of which one has been produced by the oil process, the other by bromoil, they behave absolutely alike in the inking-up, for the bromoil print receives, by soaking in cold water, a gradation which is just as short as that of the oil print. *The two prints absolutely cannot be differentiated in practice*, and are indistinguishable, if the paper, on which the gelatine film is supported, or the structure of the gelatine, does not give one a hint.

*In such cases it is impossible to determine from the finished print whether the picture was made by oil or bromoil printing.* The portfolios of some of my friends furnish striking proof of this; the authors themselves can no longer recall by which of the two processes some of their earlier pictures were made.

Nevertheless the opinion is often held that one can obtain pictures of much finer artistic quality by means of oil printing, because the prints thus made have a characteristic tonality and better treatment of masses. This opinion may be explained by the fact that oil printing has been used longer and is better known than bromoil, and that first class bromoil prints have not often been exhibited in public until recently. Especially, it has not been widely known how manifold are the effects that can be produced by the different methods of working described in this book.

There is also another explanation. Whoever has completely mastered any process and has kept in view

a definite artistic purpose, will as a rule find that the process will give him the results which he desires. It is now an indisputable fact that even such an imperfect process as oil printing has many times, because of this very imperfection, led to results which have been proclaimed as artistic. If for instance, an oil print is made from a contrasty negative, the process cannot correctly reproduce the tone values of the negative. The short gradation sets a limit to the inking-up, before the tone values of the negative are fully developed. The result is then certain to be a gloomy print with heavy masses. Technically, however, this means nothing more than that the high lights are not clean and the shadows lack detail. This does not imply that the resultant picture may not have an artistic effect. *The question is only whether this effect was actually tried for* or whether necessity was not made a virtue and the imperfections of the process called an advantage. *Without question, the worker who intentionally strives for a given artistic effect can attain this easily and certainly by means of bromoil.* If, however, he has no definite aim, but allows himself to be blindly driven on, as it were, by the idiosyncrasies of the process, it may happen that he will obtain quite another result. The greater gradation of the bromide print may induce him to keep on working on the picture until he finally obtains a print, which exactly corresponds in tone values with the gradation of his contrasty negative, which could not happen with the oil print. In such cases one often hears the opinion expressed that the special quality of the oil print cannot be attained in bromoil, and that a similar result could be obtained by any process, even printing-out paper. But the fault does not lie in the bromoil process,



but in the fact that the worker has not mastered it, and has been carried beyond his aim by its greater possibilities. *Oil printing is satisfactory when one desires a shorter gradation than is present in the negative; beyond this, however, it fails. Bromoil printing, on the contrary, permits on the one hand the shortening of the tone gradations of the negative to any desired extent, on the other hand, however, the extension of the gradation beyond that of the negative.* It offers, therefore, to the artistic aspirant a far greater liberty and in every respect a technically more perfect and therefore more effective instrument. By bromoil printing, therefore, one can prepare at will from a given negative, either a low-toned picture without detail, or one richly modeled and full of detail and vigor. *Oil printing does not offer this alternative.*

If, in spite of all this, erroneous ideas as to assumed fundamental differences between oil and bromoil printing, and particularly as the special suitability of oil printing for certain effects are still disseminated, the reason usually lies in the fact that many who have previously worked in oil have drawn erroneous general conclusions from their first and naturally imperfect results in bromoil printing. They overlook the fact that even the worker experienced in oil printing must first learn bromoil printing and then practice it thoroughly in order to master it. The oil printer does not bring to it anything beyond a brush technique, which is not sufficient for every bromoil print. Everything else must be newly acquired; especially an actual mastery of the technique of bromide printing, which many lack, though they believe they possess it. Conservative thought easily overvalues its own possessions and is likely to

show itself somewhat antagonistic to new accomplishments which cost new efforts. The worker who spares no trouble to make himself a thorough master of bromoil printing will be in possession of a technique which renders feasible, by its extraordinary many-sidedness and capacity of expression, the solution of the most difficult problems of artistic photography.

## CHAPTER VII

### BROMOIL TRANSFER

BY EUGEN GUTTMANN

THE idea of transferring a bromoil print to an ordinary, uncoated paper was first introduced by the English and later further worked out by the French. The Germans turned to this new process comparatively late, but obtained fine results. Yet the practice of this beautiful form of artistic photography was limited to a small circle of adherents, and even today, when bromoil printing, thanks to the instruction of some excellent textbooks, has become known to almost all artistic workers, one cannot state that it enjoys wide popularity. This may well come from the fact that not everyone has the absolutely necessary printing machine, and that the substitutes for this machine, such as burnishers and washing mangles, cannot bring out all that lies in the process. In addition, when the process was first introduced, the transfers were never strong enough, and were mostly muddy and flat. This happened because, in the first years of the process, strong and vigorous shadows were not produced on the paper. The English and French improved this by pigmenting the shadows of the bromoil print much more strongly than was needed for this process. They stated that the chromated film took the ink very readily in the shadows, but parted with it again very unwillingly. Thence they concluded that, in order to be able to transfer much ink to the



paper, a surplus of ink must be imparted to the shadows; they thus corrected the tone values by deepening the shadows, and contended that they produced their beautiful transfers in this way. I have never seen an English transfer, but plenty of the French, which were said to have been prepared in this way. From my own experiments extending over a long period, I doubt whether the depth in the shadows could be attained in this way, and can only assume that very important particulars have not been made known in the excellent publications on this process. A simple reasoning, without any trial, also leads to the same conclusion. If, for instance, I overink the shadows by imparting to them more ink than the tone values require, then I smother all the details in them and in the transfer I shall obtain a black, absolutely detailless patch. The English and French contend, however, that all details, which are made invisible by overinking the bromoil print, become visible again in the transfer. They thus explain the matter approximately as if we were dealing with a carbon print, in which the whole film is "reversed" during the development. This is absurd. A *moderate* overinking will obviously give better shadows, but this limitation is of no advantage.

For an important advance in the direction of the production of vigorous shadows in the transfer we are indebted to the work of Hanns Benndorf, which was described in an article, "The Technique of the Bromoil Transfer Process" (*Phot. Rundschau*, 1914, Heft 9, 10). He used the method of printing in superposition common to all gum printers, since he first pigmented the original print in a normal manner but with weaker shadows, printed it and then inked up a second time, treating this

time merely the shadow parts which were to be strengthened, and then printed it on the first transfer. The results were actually very good. But the process still required considerable dexterity; its chief difficulties appear to me to lie in the fact that in the second pigmenting it is uncommonly difficult to so bring out the shadows that they do not appear too deep in the final print, and the middle tones and high lights are thus out of tone. The process is very suitable for bringing out individual parts of the shadows.

On the other hand a considerable advance in the development of the process was made by Dr. Emil Mayer, and this consisted of giving to the bromide print, by exposure and development a particular character only suitable for this purpose. Fuller details of this are given under the heading "Combination Transfer with one Print Plate," page 125.

In most publications on bromoil transfer, directions are finally given to pass the finished bromoil print quickly *once* through the machine with a *heavy* pressure of the rolls, and at the most *twice*. This advice has received my special attention, because I found that in this way good as well as bad transfers could be obtained; but I decidedly could not count on *always* obtaining equally good results. I noticed that things went well when I had a pressure on the rolls which was suitable for the bromoil print and the structure of the paper. Getting this correct pressure was pure luck. If the pressure was too great, then I indeed got all the ink on the paper, but the shadows were wanting in detail and flat; if on the other hand it was too weak, the shadows remained much too grey.

Hence I came to the idea of so adjusting the rolls

that I printed at first with only a light pressure. I then had as a result a transfer which was absolutely white in the highest lights, yet showed all the gradations of the bromoil print in the high lights as well as in the finest and fine half-tones. The shadows, on the other hand, were grey and not filled up, for much of their ink still remained on the bromoil print. Then I again inked the same bromoil print and printed again as before, but did not take the paper from the machine, observing the transfer by carefully lifting the bromoil print. It was exactly as described above. Now I allowed the paper (the lower part of which was still held by the rollers, further details of which will be found in the section "Printing") to again come into contact with the bromoil print, screwed down the central spindle to increase the pressure, and passed the pack again through the machine. The result was highly satisfactory. The highest and the high lights, as well as the half-tones, remained as they appeared at the first pull, but the shadows were fully filled up and completely transferred from the bromoil print to the paper.

Thus I had discovered *the principle of printing with increasing pressure of the rolls*. Further experiments led me to improve the method, and the following instructions give all necessary explanations and directions.

I must remark that from the start I used a machine the arrangement of which permitted me to see the print during the printing, and with which the pressure on the rollers could be regulated at will.

The transfer is not only a step toward the greater development of the bromoil print, it is so beautiful in its results that no other photographic process, with the exception of gum printing, at all approaches it. By the



transfer process, photography has made its first entry into the ranks of the graphic arts. No positive process, other than bromoil transfer and gum printing, has overcome the oft-bewailed shortcoming of photography, that there is no sun in the picture, as well as these two processes. *It is even possible in them to use as the highest light the pure white of the paper.* In this respect transfer still has the advantage of offering a more rapid if not an easier technique.

Certainly the ordinary bromoil print also gives excellent results. Its whites are, however, formed by the photographic film, and this is its only disadvantage. There is, however, always a difference of beauty between a bromoil print and its transfer, the appreciation of which is purely subjective. We can accept it as certain that feeling in a picture printed in bromoil is attainable by simpler means than in the more difficult transfer. The photographic artist will decide for the one or the other according to the results desired.

THE BROMOIL PRINT. — *For every transfer there must be a bromoil print, complete in every part.* That is an indispensable requirement for those who desire to practise transfer.

That a perfect bromoil print can only be prepared from a perfect bromide print is generally known. It is not my province to describe both processes fully, for that was long since done by various writers in excellent works. But it is my duty to give some hints as to the way in which the bromoil print should be prepared in order to obtain the best possible results by my new printing technique, which will later be fully described.

The transfer printer must always keep in view the fact that he must prepare the way for his final *artistic*

*results* in all previous phases of the technical preparation of his print. He will, for this reason, in a careful and well planned working up of the negative, bring out the characteristics and feeling of his ideal result by toning down or suppression of such parts of the picture as may be necessary, a task which has nothing in common with the process generally called retouching. He will also make the bromide print, whether by contact or enlarging, with greater deliberation and care than is used in most cases. Too much reliance in this respect is often placed on the omnipotent technique of bromoil, which allows us to carry out the most far-reaching alterations on the print. This can certainly be done; but perhaps this way is even more difficult than taking every necessary precaution right from the start and producing it correctly — in one word: creating it.

Far too little use, for example, is made in enlarging of bolting cloth, chiffon, or some such open-meshed fabric which, according to requirements, may be used with wide or narrow mesh, or even doubled, two pieces in contact [preferably with the threads at an angle of  $45^{\circ}$ . — Trans.]. Used with discretion, this gives valuable assistance in producing an artistic softening of contours and contrasts. The same purpose is attained in perhaps even greater perfection, by using the procedure recommended by L. Vernouille of Vienna. In this method of enlarging *two sheets of tissue paper*, of the size of the enlargement, are laid upon the film side of the bromide paper, and the exposure is made through these two sheets. It is important that the time of exposure be exactly determined; this is about double that of the usual enlargement. The tissue paper must be perfectly white and free from imperfections, black specks and folds, etc.

Besides these tricks a slight want of sharpness may be used to give the desired effect, or also the interposition of ruled screens between the film and the negative.

If it is desired that the bromoil transfer shall show a canvas effect similar to that of oil paintings, the simplest procedure is as follows. A piece of cloth is cut from a material which has the necessary structure, *slightly* larger than the size of the print, and laid flat on a stiff support such as pressboard. Then a new piece of carbon paper, such as is used in typewriting, as thin and free from faults as possible, is cut to the same size, immersed in water, allowed to drain, and placed smoothly on the material; a second sheet of pressboard is then placed on top and the whole subjected to a strong pressure, say between the rollers of a burnishing machine or washing mangle; if one has not these, then in a copying press. The carbon paper shows when dry the perfect structure of the material. If this structure paper is now placed between the paper and the negative, or in enlarging in contact with the paper, the bromide print shows this structure together with a very plastic rounded image, and a longer exposure is not necessary. I consider this procedure better than the use of the commercial structure screens, since one is free in the choice of the material from fine lawn to the coarsest canvas, while among the commercial articles there is seldom one which is quite satisfactory, and of course no such variety.

The final size of the picture must be drawn on the bromide print in pencil before the bleaching, for the positions of the edges cannot be determined on the bleached-out print, especially when the bleaching is complete. After the bleaching and drying are finished,



the pencil marks should be cut through with a sharp knife on a glass plate, and the print is thus given the desired size. From this point on, one should be most careful not to touch the print with the fingers, except on the back, which can be easily done with a little care, by always lifting up the edge with a knife.

It is immaterial what bromide paper is used. It may have any surface, be thick or thin, though thick paper is to be preferred. For prints and transfers which should show the greatest possible fineness and modeling, it is better to choose a smooth bromide paper.

The prepared print is swollen and pigmented as in making an ordinary bromoil print. *It is not necessary, when planning to make a transfer, to produce a higher relief by a warm water or ammonia bath*, which requires the use of softer inks and limits artistic freedom in working up. One's whole attention must be focused on a *single point*: the shadows must be *clean*, the lights *pure white*. If this condition be neglected a good transfer cannot be expected. Deviations from this fundamental requirement are only permissible for those who have absolutely mastered the printing technique, and who, therefore, can foresee the results with certainty.

One must take into account the fact that the transfer process has a very marked tendency to lower the tones. The high lights and fine half-tones always appear somewhat darker in the transfer than in the bromoil print, while the shadows, with *correct printing*, remain the same. It is, therefore, absolutely necessary to lighten up the high lights and the fine half-tones just as much as they lose in brilliancy in the transfer. Obviously no description is of any value on this point; a few experiments made for this purpose will quickly put one on the right track.

The fact that the bromoil print is *trimmed* before being placed on the pad has caused some nervous souls to be afraid that water may thus come from the support through the brush on to the film, but this is not likely to occur. The pad should be arranged by first laying on the glass plate a thoroughly wet copying sheet; on top of this a second sheet is laid, equally wet and with no air-bubbles between. The water is completely dried off the surface of the second sheet with the aid of a sheet of lintless blotting paper, and then one can work all day long even in summer in the greatest heat without changing the support; there will always be enough moisture to produce adhesion between the sheet and the support, but one will never carry a drop of water on to the print with the brush.

THE CHOICE OF THE PAPER. — The pigmented gelatine film gives up its ink when it is brought into contact with paper under pressure; from which it seems that theoretically paper of any quality may be used for the transfer. In practice the matter is not quite so simple, for every paper surface possesses an individual character which definitely influences the ink transfer and the final result.

Papers may be roughly classified as rough, medium and smooth, obviously with many intermediate grades, each of which may be divided into sized, half-sized and unsized sorts. Whether a rough, medium or smooth structure is to be chosen, must be decided from a purely artistic point of view, and in this decision the character of the subject and the effect desired are of equal importance. It is different, however, as regards *sizing*. The quality of the picture frequently depends on a correct decision on this point. This is at once clear when

we consider that unsized paper is much more porous than half-sized or fully-sized paper, and thus can remove the ink much faster and more completely from the bromoil print. If, for example, a bromoil is transferred with a certain roll pressure on copper-plate paper, that is, on a very absorbent porous paper, the ink will be quickly transferred to it, whereas a sized paper, under the same conditions, that is, with the same pressure on the rolls, will take up only a small part of the ink. A comparison of the two transfers would then show that the shadows on the copper-plate paper are blocked up and have lost many details, while those on the sized paper appear much too light, which is readily understood, as the porous paper has taken up all the ink, the sized paper merely a portion of it.

How far these properties of papers can be equalized or used will be dealt with in the section on "Printing."

In choosing the paper destined for the transfer, therefore, attention not only has to be paid to the structure, which must serve the artistic purpose, but one must be certain of the amount of sizing; this latter is necessary so that one may correctly carry out the actual printing process.

As a basic principle the worker should use only *pure rag paper* and avoid all paper containing *wood pulp*. Although theoretically it cannot be disputed that any paper is suitable for transfer, it is also practically accepted and undoubtedly correct that *beautiful prints* can only be prepared on *good papers*, and the artistic photographer should not be induced by any consideration to use other than the best materials.

All the commercial drawing and water-color papers of all tints and structure, made by reliable firms, can be



recommended. Extraordinarily fine results are obtained on copper-plate printing paper, which may be obtained in white and yellowish tints. Equally as good, and specially suitable for certain effects, are the Japanese and Chinese papers.

The stock of paper should be kept in a dry place and free from dust.

Printing should only be effected on *dry* paper. Damp paper is used when it is *very coarse-grained* and rough, as then the ink is more easily taken in the depressions. Such sheets are best dampened by immersing them for some minutes in water, allowing to drain and passing them through the machine between two sheets of calendered lintless blotting paper with strong pressure; they are then immediately ready for printing.

If one has to deal with very absorbent papers, with which, especially in the pure whites, there is always danger that in spite of careful printing the gelatine film may adhere to the surface of the paper and thus spoil both bromoil print and transfer paper, the paper should be given a slight sizing. The preparations to be used for this should be those used by the gum printer: gelatine hardened with alum, chrome alum or formaldehyde. But these solutions must be applied warm and then the original brightness of the paper suffers. It is, therefore, more advantageous to use the *cold* preliminary coating recommended by von Hübl to prevent the sinking-in of the platinum-iron solution for platinotype; 2 g (60 gr.) of rice or wheat starch or arrowroot should be rubbed up with a little water and added with constant stirring to 100 ccm (3 oz.) of boiling water. When quite cold the solution should be applied evenly to the paper with a swab. The application must result in a

slight matt gloss on the paper without any damp places anywhere. When dry it is ready for use. The longer the paper is kept after this preliminary preparation, the better it is.

The beginner will be well advised always to use one and the same quality of paper until he has succeeded in attaining full command of the printing technique; I have already pointed out that papers of different surfaces take the ink from the bromoils with different degrees of ease or difficulty. Similar differences also occur with increase of pressure. When the operator has once become perfectly familiar with the necessary adjustments of pressure with *one sort* of paper, he will be able without difficulty to estimate the degree of pressure for other papers. At the start it is advisable to use a good, half-sized moderately rough drawing or water-color paper.

It may be remarked that transfers may be made on silk or other textile fabrics as well as on paper. If permanent results are desired, care must be taken that pure fabrics are chosen, that is, such as are not filled, as is usually the case with silk. As the fillers are usually metallic salts, they may easily have a destructive chemical effect on the inks.

THE MACHINE. — In order to obtain a good transfer, a machine is required which must satisfy to the fullest extent two requirements: the pressure on the rolls must be capable of being regulated at will before and during the printing, and one must be in a position to examine the condition of the print at any time, without danger that the bromoil print and the transfer paper will shift. By pressure on the rolls is meant the distance between the two cylinder surfaces.

The autographic metal hand press, model A, as supplied by the firm of Hugo Carmine, Vienna VII, at comparatively reasonable prices with different lengths

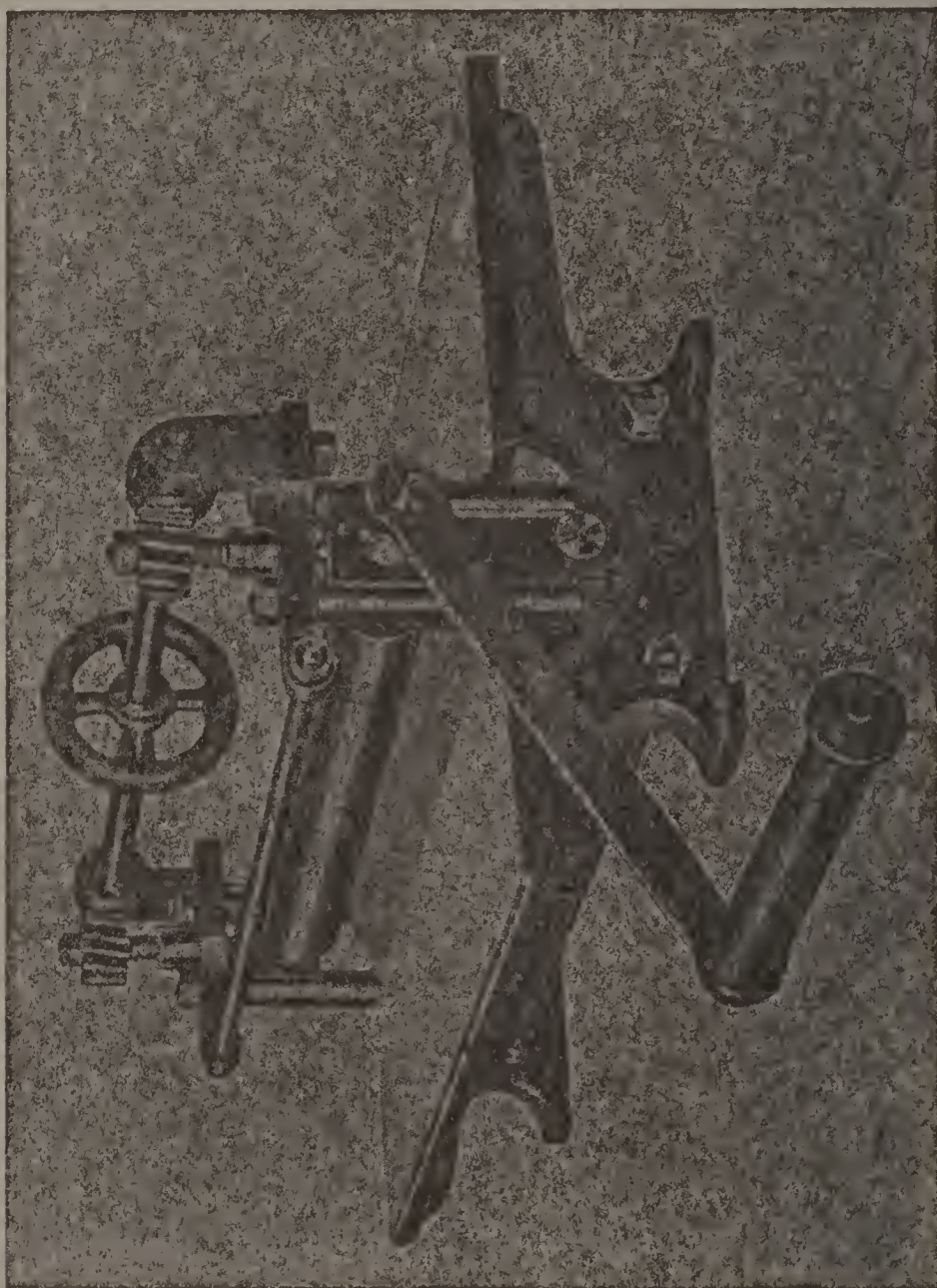


FIG. 1

of rolls, is almost an ideal machine for our purpose. It is shown in Fig. 1 and consists, as will be seen, of a massive metal stand, which may easily be screwed to any table. Through the center goes the lower roll or print-



ing cylinder, which is prepared of an elastic material, and this stands at the same height as the two tables seen on both sides. Above this lower, immovable roll, there is the upper one, which can be set higher or lower as required by the central spindle, in the center of which is the wheel. The central spindle is so arranged that the upper roll can be raised or lowered by screw gears at the right and left, the arrangement being such that absolutely even pressure is exerted at the two ends. On the right screw gear there is a notch in the form of an I, which with every half revolution of the central spindle moves the length of one tooth forwards or backwards, according to the direction chosen, so that it is always possible to produce an absolutely determinable pressure. The rolls, after the setting of the pressure, are rotated by the handle visible on the right.

This is the whole machine. Its dimensions are determined by the length of the rolls, and these are chosen as may be needed. One with 40 cm (16 in.) rolls ought to be sufficient for most work.

It may be possible to rig up existing burnishers or washing mangles. Whether good results can be obtained therewith, I cannot say from my own experience.

The care of the machine is very simple; it needs only to be oiled from time to time.

Although this, or any other suitable machine, is so simple in construction, and its manipulation is so easy, yet one ought not to forget that he who uses it ought *not* to be a machine. The printer must be very familiar with his press, if it is to give its best. Whoever does not believe this should ask an etcher, who will soon tell him how much a good printer can add to a copper-plate print.

PRINTING.—In order to obtain from any bromoil

print one or more pulls on uncoated paper, one requires, besides a printing machine, also — experience.

Before I proceed with the technical description of the whole process it will be as well that we become perfectly clear as to the conditions under which transfer takes place.

Bromoil printing has been described as a direct derivative of the collotype process, and it is. This very close relationship, however, is merely because of the common property of the exposed and swollen chromated gelatine film, but does not extend to the method of execution, in which bromoil printing displays an independent technique. The primary difference lies in the support: collotype uses a glass plate as the support for the chromated image, bromoil printing uses paper. This causes a variation in the subsequent procedure, especially when the bromoil print is not the final result, but merely the means for making the transfer. The application of the ink to the swollen gelatine also is quite different in collotype and bromoil printing, and the transfer of the ink to the paper by means of a machine is done differently, all of which are based on the differences of the support.

The bromide print, which is taken as the starting point in bromoil printing, should be made on a paper as dense in structure as possible; thick paper, therefore, is advisable, because the film remains damp longer during the work of pigmenting, and also because all subsequent manipulations are carried out more easily with thick than with thin papers. In the collotype process, on the other hand, the chromated film is carried on glass. When it comes to printing, it is clear, from what has been said, that the bromoil print not only contains the moisture which is absolutely necessary in making it, but also

that which is in the fibers of the paper. The whole of this dampness is pressed out of the paper fibers and the film, during the printing, and combines with the ink to a kind of emulsion. This *emulsion-like mass* is brought on to the paper by the machine, *not the ink alone*, as in collotype, the chromated film of which holds only that moisture which is requisite for its swelling, while its support, the glass, can retain no moisture. It is also the fact that the amount of moisture in the collotype film is so small that the formation of this emulsion practically does not occur. From these comparisons and explanations it also follows that the printing technique of the two processes must differ.

I have dealt with these facts with more completeness because it is commonly assumed that the printing of a bromoil print must be carried out like that of a collotype print, and most of the failures result from ignorance of the differences discussed.

So, while the collotype matrix only gives up its *ink*, the bromoil matrix gives up a mixture of *ink and water* to the paper. This emulsion is so constituted that it readily adheres to the paper where it is in the finest state of division, but where it is thicker it is more difficult to make it adhere. In other words: the high lights and the most delicate and medium half-tones readily transfer to the paper under light pressure, while darker half-tones and the shadows must receive a stronger pressure, from which it again follows, that in order to obtain from a bromoil print a transfer equally good in all its tones, *I must print with gradually increasing pressure*.

That is the reason that induced me to use a machine, with roll pressure which can be varied at will, as I have described more fully in the chapter on "The Machine."



The procedure in printing must now be very accurately described, and takes place as follows:

The pressure which the rolls exert on the bromoil print and the paper as they pass through must be absolutely even, at every point. In order to make the pressure more uniform than the rolls of even a good machine can give alone, it is necessary to imbed the print and the paper in a press-pack. This press-pack generally consists of two pressboards (hard, thick, glazed pasteboard), at the bottom, an ordinary pasteboard, a copper-plate blanket, that is a thick felt, and another ordinary pasteboard. On this pasteboard the bromoil print is laid, and on this the printing paper. On this printing paper there are now placed in order another copper-plate blanket, an ordinary pasteboard and finally two pressboards. Before, however, we pass a press-pack, thus prepared, through the rolls, it must be explained in fuller detail, which is best done from an actual example.

Let us assume that we have a print prepared as described in the chapter "Bromoil Printing," ready for transfer. Its size shall be  $16 \times 21$  cm ( $6\frac{1}{4} \times 8\frac{1}{4}$  in.). Our intention is to print this on paper of the dimensions of  $30 \times 40$  cm ( $12\frac{1}{2} \times 16\frac{1}{2}$  in.), and to surround it with a plate mark. As the size of the paper is  $30 \times 40$  cm ( $12\frac{1}{2} \times 16\frac{1}{2}$  in.), the four pressboards, the three ordinary pasteboards and the two copper-plate blankets should be cut exactly  $32 \times 42$  cm.

The two pressboards are accurately superposed on a table and then the pasteboard and the blanket are placed on top. On the last, as already stated, another pasteboard is placed, which must, however, be previously marked with pencil guide lines, for on it are to be laid the bromoil, the paper and the plate-mark pattern. As

we wish to surround the print, which is  $16 \times 21$  cm, with a plate-sunk mark, we must cut a sufficiently large pressboard to impress this mark. Let us say we wish to surround our vertical print with a margin which shall be 1 cm ( $\frac{3}{8}$  in. ) wide above and right and left, but 2 cm ( $\frac{3}{4}$  in.) below, then we must cut the pressboard  $18 \times 24$  cm ( $7\frac{1}{2} \times 9\frac{1}{2}$  in.). When we have done this we mark on it with a pencil exactly the position of the  $16 \times 21$  cm bromoil print. Now we find on the  $32 \times 42$  cm pasteboard the position at which we wish to have the  $18 \times 24$  cm pressboard just cut (as a rule this will be a little above the center), and fasten it there very lightly with library paste or mucilage. The  $18 \times 24$  cm pressboard now lies on the  $32 \times 42$  cm pasteboard. As the size of the paper is only  $30 \times 40$  cm, this will leave a margin of 1 cm on all sides, and this future position of the paper should be accurately marked with the pencil on the pasteboard. Extreme care having been taken that all the lines are parallel and the measurements correct, we can now place in the press-pack the bromide print and the transfer paper, and proceed to print.

The marking of the individual layers may be done very simply and accurately if it is carried out as shown in the accompanying diagram. This marking of the layers has also the advantage that we may use it for all sizes with slight alterations for individual cases. The lay-out is very easy. The pasteboard which carries the plate-mark pattern is cut accurately right-angled and must be about 2 cm ( $\frac{3}{4}$  in.) larger all around than the transfer paper that is to be used. On this board we now draw, exactly 2 cm below the upper edge, a sharp line with ink that will not smear, such as waterproof drawing ink, stopping exactly also 2 cm from each edge. Then

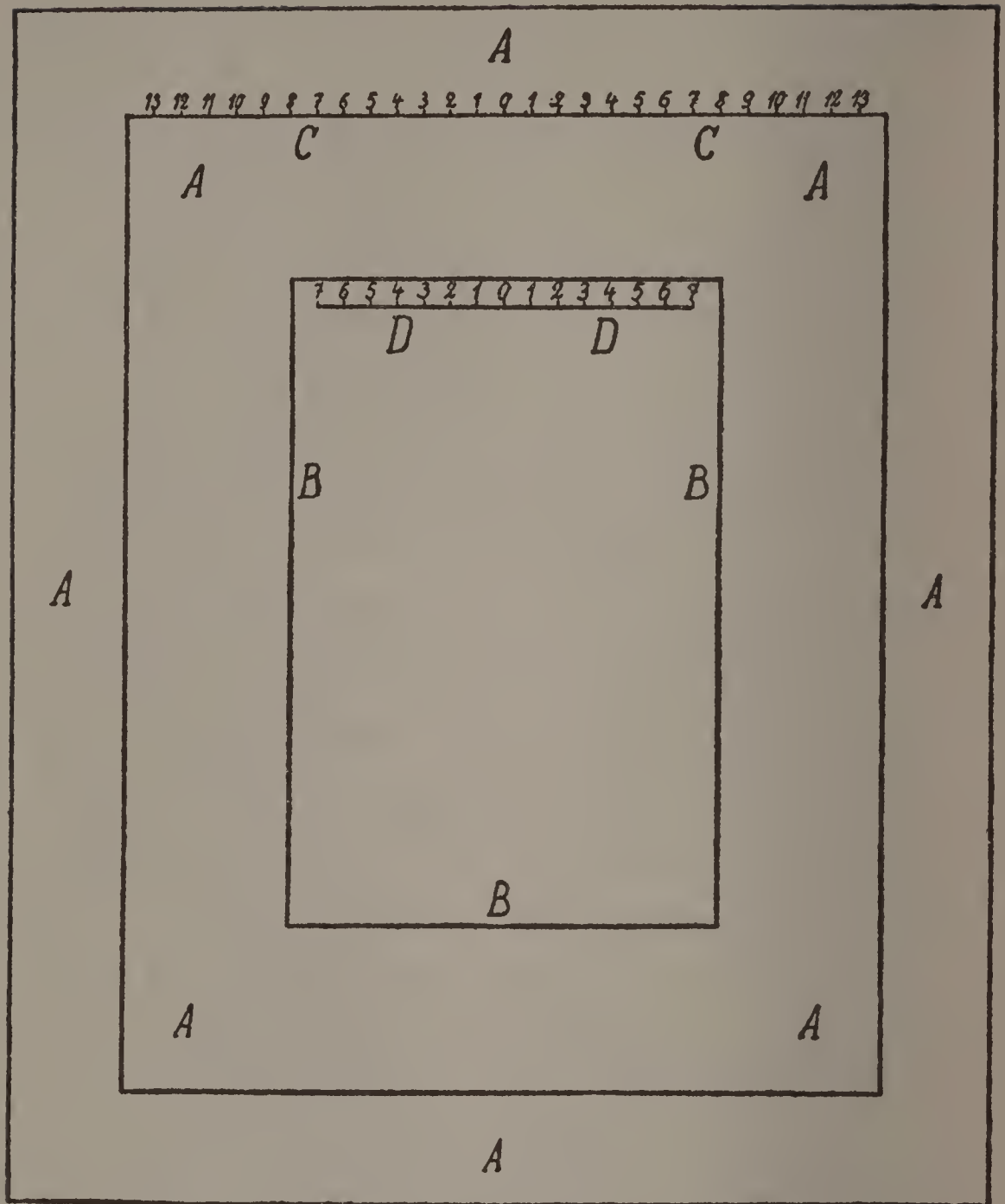


FIG. 2

A = pasteboard

B = the plate-mark pattern

C = the location guides for the transfer paper

D = the location guides for the bromoil print.



this line is bisected and the center point marked zero; right and left of this zero point we now draw equally distant upright lines, about  $\frac{1}{2}$  cm ( $\frac{3}{16}$  in.) apart, which are numbered 1, 2, 3, . . . to the ends of the line. Like divisions are drawn on the plate-mark pattern, or if this is not to be used, at the place it should occupy. The bromoil and the transfer paper are now laid down with the help of these lines so that the upper corners are equidistant from the zero point, which can be very easily done. These location guides are also very convenient in combination printing.

We now have lying in front of us one on top of each other: two pressboards, an ordinary pasteboard, the copper-plate blanket and the pasteboard with the plate-mark pattern and the marks for locating the paper.

Now the bromoil print is lifted from its pad by passing a knife under its edges, and laid carefully with its *back* on the worker's left hand. Thus the print can be laid down face up *without danger of damage* on the plate-mark pattern, adjusting it by the position guide before sliding out the hand, all without touching the face of the print. Great care must be taken that the print lies absolutely flat. It will adhere to the pasteboard without any aid except its own moisture. Now we take the printing paper, hold it at the upper third of its surface with the two hands and bring the upper edge to coincide with the pencil lines on the pasteboard which carries the plate-mark pattern, taking care that it does not touch this pasteboard. When the edge of the paper and the pencil lines coincide, the paper is carefully allowed to drop into position from the top to the bottom. It now lies on the bromoil print; now, holding it *very gently* on the bromoil print with one hand, the

previously prepared copper-plate blanket is spread out with the other hand over the paper and pasteboard, and the two pressboards are placed on the cloth in the same way. Care should be taken that the whole arrangement is fairly evenly made up, so that none of the edges of the boards or blankets project beyond others. If this precaution be omitted it may happen that the transfer paper is squeezed into wrinkles running from the edges to the middle, which may even encroach on the print itself. These squeezed-in wrinkles, which, if the pressure be great, may appear like sharp cracks, make the print useless. This whole manipulation is rather difficult to perform at first, but it is learnt very rapidly, especially if the first experiments are made with a damp sheet of paper the size of the bromoil print instead of the print itself, and one thus becomes expert.

When the press-pack has been made up in the above-described manner, it should be taken firmly in both hands, so that nothing can shift, and the upper edge placed on the machine table and guided between the rollers, the separation of which must be such that they just grip the pack *without exerting any pressure*. This separation must be determined by experiment. The pack should then be gently drawn through until about 4 cm ( $1\frac{1}{2}$  in.) of its lower edge remains protruding. Shifting is then no longer possible. The rolls should now be tightened, for which purpose the central spindle should be given six to eight *half* revolutions. The exact pressure cannot be prescribed, but it will always be better to begin with light pressure. The handle is again turned and the pack drawn through the press, until its upper edge sticks out about 4 cm ( $1\frac{1}{2}$  in.). This process is repeated four times — twice in each

direction. If, after the fourth revolution, we carefully lift up the upper layers including the paper — obviously while the lower edge is still held fast for about 4 cm by the rolls — we can inspect the *first impression* and will see that the high lights and fine half-tones have already given up all their ink, while the deeper tones still look very flat. The paper should be allowed to drop back again gently, and then the other layers. Then the pressure is increased by giving the central spindle about three or four half-turns, as, after the first impression, there is little danger to either bromoil or transfer through heavier pressure, and the pack is again passed through the rolls, but only twice, once in each direction. If the print is now examined again it will be found that the full half-tones and the lighter shadows are already transferred, but that the deep shadows do not appear in full tones. Then the printing is repeated with still greater roll pressure, three or four more half-turns of the central spindle; again the pack should only go twice through the rolls. Another examination should now show the print in full vigor in all its details. If, however, it should happen, especially when using rough papers, that the shadows do not yet appear quite deep enough, one should print again twice with increased pressure. All the ink which was on the bromoil print will now be transferred to the paper; if the printing was carried out properly the bromoil will look as if it had not been pigmented at all.

*It should never be forgotten that the rolls ought never to be so strongly screwed down that they can only be started by great effort; they must always move easily, and with little muscular effort. Repeated slow passage of the press-pack through moderately tightened rollers*



is always *more advantageous than a single printing under very heavy pressure.*

Heavy pressure not only endangers the bromoil, since the gelatine film, especially in the lights, adheres to the paper and tears when removed, but the transfer also, because the water, pressed out quickly and with great force, is deposited in the ink in the form of fine globules. After evaporation, which takes place very quickly, these places show curious, light, circular or elliptical spots, which produce the general impression of a picture painted in the pointillist manner — an undesired effect which, however, may occasionally be satisfactory.

It is very advisable to turn back the central spindle before finally taking the press-pack out of the machine, as otherwise one may uselessly and prematurely ruin the components of the press-pack.

The bromoil can be immediately immersed in water and again pigmented — as was done at first, or with different ink. This process may be repeated until the paper breaks down, with careful treatment in printing and suitable stout bromide paper, up to twenty times.

If the pressure of the rolls was too great, then the film shows blisters, which at first, and if they only appear here and there, are harmless, even when they occur on important parts of the print. If their number increases, however, it is better to make a new bromoil.

If the bromoil is to be kept for future work, then it should be allowed to become bone dry, in order to dissolve off any grease with benzol or other solvent, exactly as is done with a bromoil print in defatting. Prints thus treated can be used again after any lapse of time.

This method of printing is proper for either monochrome or polychrome impressions.

In conclusion the fact may be mentioned — first published in France, I believe — that bromoil prints, which in the course of making have been soaked in ammonia water, can be more easily transferred, and that there is less danger of the bromoil print and the paper sticking together, even with very strongly absorbent papers.

Robert Demachy has stated that transfers can also be prepared by removing the ink, not by a press, but with a solvent, such as benzol, by moistening the paper with this solvent and then bringing it into contact with the pigmented bromoil. My experiments in this direction could not be brought to a conclusion, as at the time I undertook them a suitable solvent was not available. I had only succeeded in determining that it is very important that the bromoil print should be allowed to dry thoroughly — from six to eight hours — and that then a less volatile solvent than benzol, such as heavy benzine, or best of all, gasoline or petroleum ether, can be used. If the bromoil print is laid on a sheet of paper and moistened with this, then pressure in a printing frame is sufficient in order to obtain a transfer. A machine is not required.

The pictures which I have obtained in this way have not been satisfactory, up to the present time; the cause of the failure obviously was that I lacked experience as to the necessary degree of moistening and the duration of contact. As stated, for lack of materials, I was obliged to discontinue experiments.

COMBINATION TRANSFER. — The process just described permits the transfer of all that was in the bromide print. If, however, it is a question of improving the inadequate gradation of a bromide print from a long-scale negative, we must use other means. Bromide

paper has only a limited scale of tones and therefore cannot reproduce the full modulation of a negative of full gradation. If the details in the shadows are to be retained in such a case, then the high lights will appear bare; if well-modeled high lights are desired, then we risk blocked-up shadows.

This difficulty has been largely overcome by Dr. Emil Mayer, by the introduction of a combination printing process for bromoil transfer, of which full details will be found on page 125. He starts from the above-mentioned fact that bromide paper does not reproduce the whole scale of tones of the negative, when this is too long, and therefore divides the tones of the negative into two parts by exposing one bromide print only for the shadows and the adjacent half-tones, and a second merely for the high lights and the lighter half-tones. He then transfers these two constituent prints in superposition and thus obtains the full gradation of the negative. It is thus possible therefore to lengthen the scale of tones *of the negative*. If, however, it is merely desired to extend the scale of tones of *the bromide print*, then it is sufficient to make the combination transfer from one print only, which must, however, be prepared in a way differing slightly from the usual.

I will not repeat here the theory of the two kinds of combination transfer, which may be found in an earlier chapter by Dr. Mayer (page 125), but in giving my own instructions for the practical performance of the process, I have essentially adhered also to Dr. Mayer's instructions, with his full permission.

COMBINATION PRINTING FROM TWO BROMOILS. — It has frequently been pointed out in the literature of the gum process that the best positive transparencies may



be obtained from a *long-scale* negative by making *two* positives from the one negative and then bringing these two positives into superposition; for this combination, one positive must be *fully exposed* and *developed soft*, the second, on the other hand, kept *hard* by a *very short exposure* and *full development*. If these two positives are laid film to film, "there is obtained," as von Hübl wrote as early as 1898, *in applying this method to gum printing* (see Eder, *Das Pigmentverfahren, der Gummi-, Oel- und Bromöldruck*," Halle, 1917), "a result which often surpasses, in truth and fidelity to the original, a normal print from the negative. In such a combined print the high lights are derived from the short, the shadow details from the long-scale negative; the two images supplement each other and reciprocally increase the brilliancy. It is also possible to make good defects in the negative or the printing process."

This same principle is used in our process, although not exactly as in gum printing. The process itself is not difficult. It is necessary to make two perfectly registered bromide prints, which is most easily done by always placing the printing frame in the same position in filling, as for instance by fitting the same two sides into a rigid iron angle fastened on a drawing board, or, in enlarging, by using a right angled piece of strong, black card glued to the enlarging easel, and fitting the paper into this angle. I have prepared a simple and absolutely certain arrangement for securing registering prints by having a beveled-edge rectangle cut out of sheet iron 2 mm ( $\frac{1}{16}$  in.) thick, the opening being somewhat smaller than the bromide paper. Thus, for instance, for  $24 \times 30$  cm ( $9\frac{1}{2} \times 12$  in.) paper, the cut-out is only  $23 \times 29$  cm ( $9\frac{1}{16} \times 11\frac{3}{8}$  in.). *Care must be*

*taken in this work, however, that the bromide paper for both prints is taken from the same packet, since only identical papers expand absolutely equally in the baths and contract equally in drying. Although the paper used by the manufacturer may be of the same quality, yet it may not always be handled exactly the same in coating, so that a registration of the prints may not be possible when one uses paper prepared at different times.*

The *first* print is now *very fully* exposed and developed soft, just long enough so that the high lights and upper half-tones are well brought out. When this is attained, development is stopped *without paying attention to the shadows*, which will be full of detail, but weak.

The second print is exposed as briefly as is required for the perfect reproduction of the shadows, with the use of a hard-working developer. As soon as the shadows appear in full depth, the print should be rinsed and fixed. The print then shows, besides the shadows, only the transition into the half-tones. It is not easy to give more accurate instructions for the preparation of the bromide prints, as the work must be carried out differently according to the negative. Only, *as a hint*, and nothing more, it may be stated that in a print where exposure of about twelve seconds was required for the complete printing of the high lights and half-tones, the shadow print needed only about three seconds, or about one-fourth the exposure. This ratio obviously alters in accordance with the depth and quality of the shadows in the negative, and must be left to the feeling and experience of the worker. When the two prints have been developed, fixed, washed and dried, they should be tested for equality of size by measurement with a millimeter scale. Then rule pencil lines around the edges

of the prints very exactly, and treat them in the usual way in the bleaching bath, the second fixing and washing. When thoroughly dry the pictures should be cut along the pencil lines with absolute accuracy, and their registration again tested. It is advisable to write on the back before bleaching "high light print" and "shadow print."

Pigmenting is effected as usual. Practically, one should always begin with the *high light print*, as this is intended to give the finest modeling in the high lights and half-tones, while the shadows are treated so that they show all the details, but no depth. This order of working leaves one absolutely free in the treatment of the fine tones, independent of the depth of the shadows. These depths are produced in the transfer in any desired strength by means of the second bromoil. If, however, the work is started in the reverse way, by printing the shadows first, then the half-tones and high lights must be adjusted to the existing depth, which may produce a dislocation of the tone values, even to a destruction of the whole desired effect. The best way is therefore to direct the whole attention in the first place to the lighter parts of the picture, and to suit the shadows to these.

When the *high light print* is completed as desired, the transfer may be made. The bromoil print is placed on the location guides, described in the previous chapter on "Printing." Then the transfer paper is placed on its guide and pencil lines very carefully drawn across the edges of the back, on to the pasteboard. Then it is printed. The picture will now appear in full beauty as regards the lighter tones, but obviously as a whole will be flat, since the shadows are grey and without depth.



Now we proceed to the working up of the shadow print, which when complete should appear absolutely bare of high lights and *light* half-tones. No protective measures to prevent the sticking of the non-pigmented parts to the transfer paper are necessary, as these white portions of the shadow print are already covered from the first transfer. The print is now placed exactly on the marks made on the plate-mark pattern before the first transfer, the first transfer also brought into the same position by the marks on its back and their prolongations, which is very simple in practice, and is then printed. The transfer now shows the full gradation of the negative, or the sum of the gradations of the two bromide prints, which, however, will be enhanced in effect by the plastic softness produced by the double printing. If it should be necessary to strengthen any part of the print, to deepen any shadow, we can again pigment the necessary portion of the proper bromoil and transfer it to the picture by a third printing, for it is thoroughly practicable to superimpose as many impressions as may appear necessary from an artistic standpoint.

This method of combination printing from two bromoils is the best attainable result in the present state of the art, but contains also the germ of future developments, especially as regards color photography, which problem appears to me to be most easily solvable in this, purely artistic, way. Only it is necessary to find an artist who can conduct the various printings with such fine color sense that the final result will actually produce the impression of a *work of art* in color, not that of a colored photograph, which has unfortunately hitherto been the case with all experiments in this di-

rection. This is obviously nothing more than a hope for the future. For the present we must content ourselves with what has actually been attained, which is no more and no less than to bring us close to our aim, ability to consider and use the photographic plate merely as a foundation for our graphic art.

COMBINATION PRINTING WITH ONE BROMOIL. — It is frequently not easy to reproduce perfectly in the transfer the whole scale of tones present in a given bromide print; or at least in many cases a high degree of skill must be employed. It is consequently often very much simpler to make *two transfers* from the *same* bromoil, one being inked up for the light parts, while the other is used to fill out and deepen the shadows.

The practical execution of the process is as follows: the bromide print is swollen in the normal way and pigmented with a *soft ink* suitable for the high lights, the shadows being very lightly inked. The transfer obtained from this bromoil print shows all the details in the high lights, with grey shadows. The print is now immersed in cold water to swell again and then inked up with a *hard ink*, so that only the shadows and the adjacent half-tones are fully worked up. This print is now transferred to the same paper, so that a transfer is obtained in which the scale of tones of the bromide print is considerably lengthened.

A second method of making two transfers from one bromoil is first to swell it normally, then ink up thoroughly and transfer. It is then highly swollen with ammonia and the shadows only treated with hard ink. The result of the second transfer on the first one is again full gradation in the print. This method, however, is not very advisable, as the print cannot be used

again if the second transfer is not successful. It is better to adhere to the first method, and preferable to use two inks of different consistency rather than two differing degrees of relief.

If, however, the combination transfer from a single bromoil is to give the best possible gradation, the exposure and development of the bromide print must be properly done, the process being essentially that of Benndorf, referred to on page 143.

The bromide print must be fully exposed and developed very soft; the image then seems flat, and yet every gradation of tone present in the negative is actually shown in the bromide print. If a print thus prepared is treated with inks of two consistencies, the best results are obtained.

THE VALUE OF COMBINATION PRINTING. — With the aid of combination transfer it is possible to solve problems in the bromoil printing process, which were hitherto unsolvable, and Dr. Mayer correctly remarks at the end of his treatise: “The transfer process has advanced to the first place and in future in the hands of the expert, bromoil printing is likely to be considered as a process of secondary importance.”

I was early convinced that transfer would replace bromoil printing and am absolutely of the opinion that combination transfer will do its share in making my opinion universal. Still I do not believe that it is necessary to use combination printing in all cases. I would especially warn the beginner against using it exclusively; he should rather endeavor to make simple transfers starting from a perfect bromide and a perfect bromoil print, for by this means he will attain much more certainty in printing technique. Only when he has abso-



lutely mastered this technique, should he begin experiments in combination transfer from one bromoil.

*Every worker should endeavor to use the technique of combination transfer for the execution of an artistic idea, rather than for overcoming technical difficulties in single transfer.*

Then it will, however, always give excellent results. Aside from the solution of such problems as views from a dark space into a brilliantly lighted distance, or pictures of falling water in conjunction with its dark surroundings, etc., it will be especially useful to the portraitist in treating his backgrounds.

Combination transfer from two originals will, however, be most valuable artistically, when there is a question of combining sharply defined parts of a picture with softer parts. Thus, for instance in a landscape, we may make a sharp print and, by the use of bolting cloth, one with soft outlines; the parts which it is desired to emphasize will be worked up on the former and artistic softening added from the latter.

Briefly, the possibilities are so many that they can hardly be indicated, not to speak of describing them in full. This is, besides, hardly necessary, for the worker who has reached full mastery of combination transfer is necessarily so far advanced artistically, that he will find out for himself all that is necessary.

RETOUCHING AND WORKING UP.—A good bromide print can only be prepared from a good negative. So says the expert bromide printer. The bromoil printer *requires* a faultless bromide print as the fundamental condition. The transferrer, finally, will not use an imperfect bromoil print for transfer.

I belong to the school which would produce a photo-

graphic picture only by purely photographic means, without, however, being too orthodox; I would not, therefore, repeat the whole laborious making of a bromoil print, because I might not think it photographic to spot out with water-color a small spot the size of a pin's head, or to remove a small particle of ink with the etching knife. This is actually not retouching, but there are people who consider these changes as such.

By retouching I mean the justly condemned excessive "working up" of a *positive* print, that is a change of values on the finished print. That should not be done.

Bromoil printing is still that exquisite process which permits the correction of false tones, the suppression of undesirable and the emphasis of the most characteristic details in the most extensive way *during the work*.

I consider it objectionable to leave all faults which occur during the long process of picture making, for the sake of convenience, to be improved on the positive print. But if it does become necessary to use retouching on the transfer, it can be done with a soft eraser. An excellent means of working up larger areas has been described by Dr. Mayer (see page 123), which consists in working on the transfer with the same brush and the same ink as was used in making the bromoil. Thus clouds may be imitated by pigmenting the white surface and then working in the clouds with the eraser, etc.

Since, however, this and other improvements can be carried out, not only as well, but even better on the bromoil print itself, it is advisable to do so much with the brush that nothing remains to be done on the transfer.

DRYING. — As soon as the transfer leaves the press, it is finished, but as the ink is very easily smeared it is advisable to leave it exposed to the air for two or three

days. After the lapse of this time the ink has usually hardened.

Very heavily inked prints require from eight to ten days to dry and may be considered as absolutely dry when the oily sheen which can be seen immediately after printing, especially in the shadows saturated with ink, is replaced by a velvety, perfectly matt surface.

Retouching can be begun about one or two hours after it has left the machine.

A transfer should not be mounted, for it looks best as it is, if the margin is sufficiently large.

CONCLUSION.—The technical difficulties of making a good transfer are not small, and to overcome them requires a certain degree of skill in the worker, which other processes do not require to an equal degree. By “workers” I mean especially amateurs, not those professionally skilled in the graphic arts. After overcoming these difficulties, caused chiefly by the materials, there is a certain feeling of satisfaction in having actually produced a work of art. By using the different techniques of bromoil printing: soft ink, hard ink, sketch, and coarse grain, one can obtain transfers of such beauty as may confidently be said can be attained by no other process. There is unlimited possibility of variation; and this alone assures the bromoil transfer process preëminence over any other method of printing.

That a transfer can be used as a basis for working up with pastel and water-color need only be incidentally mentioned, because such work is outside of pure photography and it is unnecessary to express an opinion as to the artistic value of such productions in this place. The photographer should always adhere to the fundamental law: Do not forsake photographic methods.



## CHAPTER VIII

### THE PREPARATION OF BROMOIL INKS

BY EUGEN GUTTMANN

EVERYONE who devotes himself to the higher aims of photography, and studies the works of painters, must learn to see with the artist's eye if he will apply his knowledge in pictorial presentation of his subjects. In the same way the bromoil printer should become more familiar with the working tools of the painter, and especially with the most valuable material at his command, the ink, than has hitherto been the case.

When we look back on the history of painting, we note the often-mentioned fact that not only the old masters of all schools, Italian, German and Dutch, but also the later generations till about the middle of the last century, ground their own colors. They did this not merely to be assured of the most perfect purity and thus absolute permanency, but also because they wanted to obtain the greatest possible brilliancy.

As regards the purity of the materials used — the colors and the mediums — there is no doubt that to-day, thanks to the high perfection of manufacturing methods, this can usually be depended upon; but as regards the brilliancy, no positive instructions of any kind for obtaining this have come down to us. The painters took their secrets with them to the grave. But as the result of exhaustive research, together with advances in the manufacture of colors, we can assume with some cer-

tainty that the masters of past times attained *vigor in their colors chiefly by the finest possible grinding of the colors and by a relatively small addition of medium*. "It may sound paradoxical," says Professor Th. Petruscheffsky in one of his treatises on the technique of painting, "but it is, however, true, that in oil painting oil should be avoided as much as possible."

The old masters knew this and acted accordingly, and the modern manufacturer also knows it, and replaces *any excessive quantity* of oil in the medium, which is mixed with the pigments to bring them into a paintable form, by other substances, for instance turpentine, and certain resin solutions, which have no binding properties; during the work these substances evaporate and leave behind the color with very little medium.

These facts the bromoil printer must know, for he should also use colors from which he can get the very best possible results.

The ink is one of the most important parts of his equipment. This fact was fully recognized by English, French, and German manufacturers, and inks were obtainable that left nothing to be desired. At the outbreak of the war the position of affairs was immediately altered. It was not possible to use English and French sources of supply and the German supply gradually failed. What was furnished as ink for the oil process was suitable for anything else but that — a soft, smeary and smearing mess, which did not permit any finer working up of the picture, and required so high a relief that individuality in the work was excluded.

These conditions induced me to try and prepare the necessary inks myself, and after many trials and exhaustive experimental study of the manufacture of artist

oil colors I finally succeeded in reaching my goal.

INKS AND BRUSHES. — My starting point was a great desire to make a *hard* ink, since I recognized that this consistency was the necessary starting point to be able to use any degree of relief. I further desired to attain a mixture of color and medium which should be as perfectly homogeneous and as fine as possible, and moreover to provide a palette, which should not only satisfy all requirements of the bromoil printer, but also give him only fast colors, perfectly suitable for the transfer process and soluble in benzol.

Command of a *hard ink* — *which can be suitably softened to meet any need* — is very necessary to the bromoil printer, if *clean shadows* are to be obtained. As already mentioned, it has long been known among painters that the colors appear purer and more luminous when they contain as little medium as possible. In order to be able to apply such stiffly ground colors, the painters use bristle brushes, which do not produce the same results as hair brushes. Naturally there is nothing to prevent the bromoil printer from using *bristle brushes*, only they must fulfil certain requirements. The literature of bromoil printing gives many hints on this point, but I have not been able to locate a practical use of these brushes. Some years ago I had made, by a manufacturer who makes excellent hair brushes for our process, bristle brushes in stag's foot shape. The result was extraordinarily gratifying. These brushes do not drop their bristles nor do they suffer from the troublesome breaking off of the points, they do not pick up the dust and do not smear even when very soft inks are used, because the bristles, unlike hairs, do not cling together. They can be easily and thoroughly cleaned and are ob-



viously very lasting, and in addition cost only a fraction of what must be paid for really good hair brushes.

As regards the size one is not limited, as with the hair brushes, to small sizes, since the hog's bristle brushes can be made of any desired diameter, even 10, 15 or 20 cm or more (4, 6 or 8 inches or more) so that the working up of large prints is considerably facilitated.

Two conditions must, however, be carefully observed for good results. First, these brushes must actually be made from the *very finest cut* bristles and, before they are used, they must be *repeatedly and very thoroughly cleaned*, because they are very dirty when purchased.

The principal advantage of these brushes is that they *enable one to use considerably harder inks* than is possible with hair brushes, which results in *much greater clearness of the shadows*. When this clearness of the shadows is obtained, one can always use a hair brush for working up the finer half-tones and high lights. This is, however, not necessary, at least in the majority of cases.

I have *not* noticed any disadvantage in the use of these brushes; the gelatine has never been pierced, even in the highest reliefs.

Although I am averse to anything that may smack of advertising, yet I will state here the source of these brushes, because the expert manufacture of these tools, so important in our handicraft, is not found everywhere in equal perfection, and because I believe that it will be of considerable service to those wanting brushes. The brush manufacturer is Magnus Bühler, Wien VII, Breitegasse 4, Austria.

I might add a word here as to the cleaning of brushes in general, whether hair or bristle. It is usually recom-

mended to wash out the ink with benzol or similar solvent, carbon tetrachloride, trichlorethylene, etc. A really thorough washing is never obtained with these; and the brushes almost always give up a greater or lesser quantity of small particles of ink to the new print when used again. The following process is much better. The



FIG. 3

brush to be cleaned should be dipped into lukewarm water and then rubbed firmly on a piece of ordinary soap (soft soap is better), so that it takes up as much soap as possible. Then the soap should be worked up into a lather on the palm of the hand and washed off. If this is repeated a second time and the brush is then

rinsed two or three times in lukewarm water, repeatedly changed, the brush will be far cleaner than can be obtained in any other way. After it has been well rinsed and shaken out it should be put into its tube and hung up by the handle in a place free from dust to dry (see Fig. 3). This vertical position has the effect of facilitating the draining of the moisture from the quill base, where it otherwise collects. Any brush thus treated will be dry in a few hours. The finest hair brushes are not damaged at all by this treatment, which is commonly used by painters.

THE PREPARATION OF THE BROMOIL INKS. — The preparation of the bromoil inks is very simple. The following are necessary:

Linseed oil varnish of the thickest consistency;

Powder colors;

A rubbing plate;

A pestle;

A springy spatula (palette knife);

A stiff spatula, the so-called ink knife (putty knife).

The following sections will give the necessary information as to the properties and nature of each item in this small arsenal.

THE VARNISH. — Only such varnish should be used as is prepared from linseed oil and chemically pure. Its color should be light to brownish-yellow or at most reddish-brown. Dark brown or blackish-brown varnish points to adulteration. The smell is that of linseed oil and is not exactly pleasant, but it should not smell badly. In the latter case one may reckon with certainty on the addition of fish or resinous oil. One principal requisite of this varnish is that it should be absolutely *clear*. The varnish is produced of various consistency, from



quite fluid to quite viscous, and *this is one of the principal properties, to which the bromoil printer must pay special attention, for every degree of consistency demands and must have only one definite quantity of color*, otherwise the resultant ink will not satisfy the desired end. More as to this later.

I used for all my experiments and later for all actual mixing the linseed oil varnishes, No. 1 and No. 2 (chemically pure) of the firm of Kast & Ehinger, of Stuttgart, which have always given me excellent results, without failures. Excellent also is the somewhat less stiff "colotype varnish." But any other varnish, if it only has the right consistency and is not adulterated, must also give good inks, though great care must also be taken as to clearness and color.

Warning should be made against oils similar to varnish, which can be recognized by a cloudy appearance and a very unpleasant rancid odor. They harden very quickly and thus become useless and are very costly.

The stiff varnish is very viscous, like thick syrup. In the cold it thickens with the formation of a thin skin on the surface. On a hot water bath, it again obtains its original character. Well corked up, good varnish will keep for years; it even becomes better by long storage. It is most convenient to fill the varnish into small wide-mouthed bottles, holding from 20 to 40 g (about an ounce), with ground-in stoppers, as one can note its appearance at any time through the glass. In taking the varnish out of the bottle, care must be taken that none gets on the inside of the neck, or else the bottle can only be opened with difficulty through the varnish gumming it up.

POWDER COLORS. — Only such colors should be used

as are fast both to light and air. The following may be selected with absolute certainty:

For black: bone black, ivory black, crayon sauce;

For brown: burnt umber, burnt sienna, burnt dark ochre;

For yellow: cadmium, light and dark, yellow ochre, light and dark;

For red: English red, light and dark, Indian red;

For blue: indigo, ultramarine, cobalt blue;

For green: cobalt green, light and dark, Bohemian and Veronese earth;

For white tones: zinc white.

The bromoil printer obviously does not need all these. One representative of each group will be quite sufficient, and I should state that when colors are obtainable in both light and dark shades, the light one should always be chosen.

The colors must be very finely ground; it will not be necessary, or only exceptionally, to prepare the powder colors oneself, for they can be obtained commercially in every high grade store dealing in painters' materials. If, however, this becomes necessary, then the lumps of color should be crushed on a stone or glass with a flat muller, and the coarse granular masses thus formed kneaded with a little water, or, better still, some *alcohol* and then thoroughly ground. The mass should be allowed to dry thoroughly and the process repeated two or three times. *The finer the powder is rubbed up in this way the finer the tone it will give.* The coarse color powders, often found in drug stores, are not suitable for our purpose; they are used more for industrial purposes.

*Aniline* colors, or those brightened with anilines, should be absolutely avoided, as they stain the gelatine and

thus spoil the print. On the other hand I call the attention of all bromoil printers to the *pastel colors*, which can be used with excellent results. They offer many advantages over the powder colors, since among the hundreds of color shades, in which they can be obtained, it is easy to choose that which is most suited for the subject. The tints are ready to use, while with the powder colors the desired tint can only be obtained by mixtures. These colors have the further advantage of covering much more strongly, even to obtaining brush texture; they are somewhat more difficult to apply to the print, because of the fact that they are mixed with a medium which is from its nature not so well adapted to our process. Those, however, who have well mastered the brush technique, will easily overcome this small hindrance.

If the pastel colors are used one should only take those of reliable manufacture, such as those made according to Mengs' formulas, which are everywhere obtainable under the name of *Meng's pastel pencils*, though this does not mean that those of other makes will not give excellent results.

THE RUBBING PLATE. — For this we use a thick plate glass slab, ground on one side, about 15 by 20 cm ( $6 \times 8$  in.).

PESTLE OR MULLER. — A pestle of glass is the best. The head must be round, not flattish, and have a matt surface.

SPATULAS. — It is necessary to have a flexible spatula (palette knife) about 1 cm ( $\frac{3}{8}$  in.) wide and a stiff one, an ink or putty knife, about 4 to 5 cm ( $1\frac{1}{2}$  to 2 in.) wide.

Now that we have become conversant with all the necessary materials, I come to the:



PRACTICE OF INK GRINDING. — As I have mentioned above, the purpose of the work is to obtain an ink of as stiff a character as possible. To this purpose, after the vessel in which the varnish is kept has been allowed to stand at least 10 minutes in hot water, or an hour in winter, we remove from it by means of a wood or glass rod a very small quantity of the varnish, spread it on a glass plate and rub it with the pestle so that it covers a surface of 3 to four qcm ( $\frac{1}{2} - \frac{3}{4}$  sq. in.). To the varnish thus spread out we add with the flexible spatula a small quantity, about as much as will lie on the end of a pocket knife blade, of the powder color and rub it with the pestle until certain that the color is absolutely mixed in. If too little color has been taken, more should be added and rubbed again until a firm doughy mass is obtained which has a *slaty and not oily gloss*, and can scarcely be worked with the pestle. Now with the springy spatula the whole ink mass is pushed together from the edges to the middle to make a little heap, and the ink that remains on the pestle scraped off and added to it; the whole mass should then be again worked up with the pestle and this procedure repeated two or three times. Then the ink is ready. It must be so hard that a brush set into a small quantity of the ink that has been taken from the heap with the stiff spatula and spread out in a thin film, neither takes up the ink nor gives it up again to white paper. In order to make it fit for use, one must add to this thin film *one* small drop, not more, of pure linseed or poppy oil, petroleum, light copper-plate printing varnish, or medium, and mix it well with the ink with the stiff spatula. Petroleum can be highly recommended for the softening medium. One can use the ordinary lamp

petroleum, but the so-called purified petroleum is better. It ought only to be added to the ink drop by drop. Now the brush will take up and give up the ink. If it should not be sufficiently soft, the procedure should be repeated, but always carefully, so that too much linseed oil is not added and thus the ink made too soft. If we use the pastel instead of the powder colors it is not necessary to break these up first. Small pieces broken from the pencils dissolve readily in the varnish. It would seem permissible to assume that the whole work of dilution with linseed oil could be saved by not adding so much color to the varnish, but by proceeding with the inking-up as soon as the ink is taken up by the brush, *but this is not the case.*

As I have stated above under "Varnish," every degree of consistency of the varnish requires a definite quantity of color. If one adds too little color, the paste will be too soft for bromoil printing, and cannot be spread. Too much color is hardly possible with the stiffest consistency; the limit lies when the color no longer dissolves in the varnish. Too little, on the other hand, results in the ink smearing on the print. *It is, therefore, absolutely necessary* in using very thick *varnish* to *absolutely saturate* it with color. *Not going far enough in this direction*, or the omission of the preliminary warming of the varnish, *are the only sources of failure.* In working with varnish of lighter consistency, it will be necessary to stop the addition of color as soon as the slaty gloss appears.

If the grinding of the ink were to require as long as it takes to read this description, the waste of time would be considerable. Actually the whole work may be carried out in two or three minutes if one uses the

methods suggested, and after a little experience is gained, which soon comes after a few trials. Long before the water for the bromoil print is hot, the ink will be ready.

INK MIXING. — As it is not always possible to use existing colors, and it is necessary in many cases to alter the shades for artistic effects, the basic colors must be diluted with other colors. This can be effected in many ways, best by adding another color to the predominant color powder during the mixing. *Bone black* is specially valuable for this purpose. This is by itself an unpleasant color, for it is a discordant brown-black which can hardly be used alone. If other colors, however, are added to this bone black it produces beautiful tones. Thus, for instance, the addition of a minimum of blue (indigo or ultramarine) gives a *deep, velvety black*; if a *little* more blue is added, we obtain a beautiful blue-black. A little bone black mixed with burnt umber gives a fine *warm black*, and so on.

The tone of crayon sauce is especially beautiful, if it is used without the addition of any other color, and especially that quality obtainable under the name of *Sauce Velours* is particularly excellent.

Another kind of color mixture is that in which black is taken as *the fundamental color* (which is desirable when it is not desired to mix up ink for each print) and then instead of diluting the *stiff* ink with linseed oil or other diluent, an ordinary good copper-plate ink or even ordinary *oil colors* are used. By this method of working I can shade and soften in one operation, and it is highly advisable to use it when it is desired to obtain different tints easily. The method of mixing is very important and I will therefore give some examples. If



to the stiff black ink (bone black), I add a little indigo *oil* color, I have at once a deep black; the addition of vandyke brown or burnt umber gives a magnificent brown; a fine dark green is obtained with light cadmium; this dark green becomes blue-green when I add a little indigo. An admixture of caput mortuum shows violet tones; red tube colors, such as Indian or Pompeian red, ochre, etc., give various reddish brown nuances. These additions can be varied in manifold ways, dependent only on what tube colors are at hand. It is strictly necessary, however, that only the least possible quantity of tube color should be added, about as much as the head of a good-sized pin, to keep the ink from becoming too soft and going beyond the desired tint. When a suitable shade has been attained, all further dilution must be effected with linseed oil, petroleum, etc. When I specially recommended the Mussini or Fiedler colors, it was because they are prepared with resin oils and are therefore specially suitable for our purpose. But all other *good* oil colors can be used. When I write briefly only *oil colors*, I mean obviously *artists' oil colors*, and not others which may be used for other purposes than for artistic painting.

Finally the black may be diluted with linseed oil to the usable consistency of hard ink and also diluted on another part of the palette with oil color or copper-plate ink of another shade to the consistency of a soft ink, and then both colors may be mixed either on the print or in the brush.

Very fine gradations may also be produced as follows: the bromoil print is pigmented as usual to obtain as *clear* shadows and *clean* high lights as possible, with not too high a relief. When the print is completely finished,

it should be placed in a 2 per cent cold solution of ammonia, this allowed to act for two minutes and then rinsed for one minute in clean water. Then the print, which is considerably swollen, should be very carefully dried off, so that no ink comes off on the cloth, and the latter leaves no imprint of its structure. Now the whole print is gone over with a clean brush, on which is a *very little pure oil color*. By thus using light, transparent (*lasur*) colors, and only such ought to be used for this purpose, the print may be given an extremely delicate film of ink, through which the first image shines with full vigor. This gives an effect similar to that which the gum printer obtains by multiple printing.

According to whether the whole or only parts of the print are gone over with the "lasur" color, the most varied effects are obtained, such as deepening of the shadows, or lowering of the high lights, or both.

It is naturally impossible to describe this process exactly in print. Much must be left to artistic feeling, without which hair-raising color discords will probably be produced. Still, in order to give the beginner some starting point, it may be mentioned that black, brown or red tones may be easily treated with inks shaded towards grey, blue with pure grey, and so on.

The following summary of color mixtures for the beginner is also given: *red-brown* is obtained by mixing bone black, Indian red, and possibly dark alizarin lake; *violet* results from bone black with red and blue; *dark green*, from black, cadmium and blue; *brownish-green*, from black and indigo; *bright green*, from a little black with cadmium and indigo; *red chalk*, from black, brown and Indian red.

The individual tints will obviously vary considerably,

according as more or less of any given color is taken. This is entirely a matter of taste and must be left to the judgment of the individual.

When the stiff ink is ready on the glass plate, it is advisable to carry out all further manipulations on a white porcelain palette or tile, because the mixtures can be much more easily judged in tone and consistency on

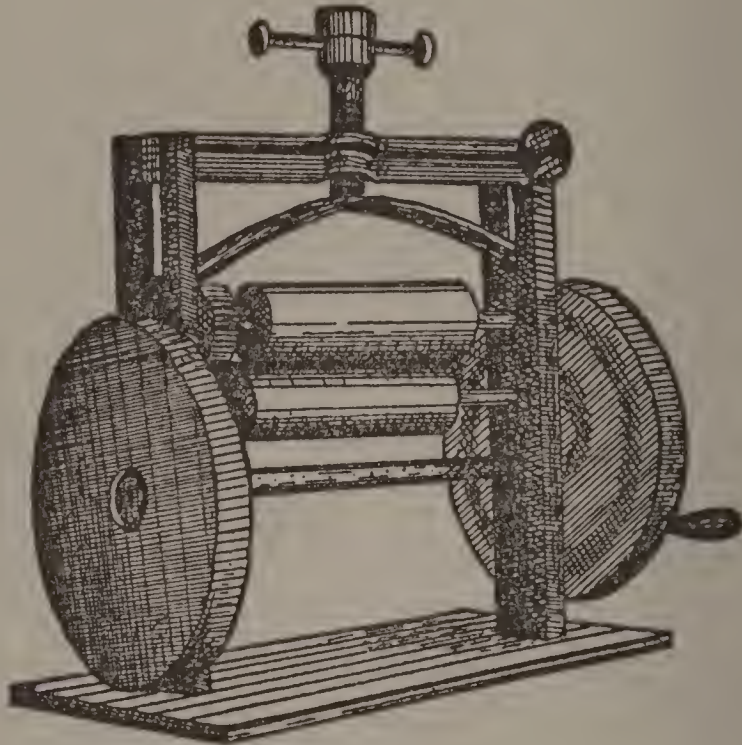


FIG. 4

these white supports. The mixtures are best made with the stiff spatula (putty knife).

PERMANENCY. — The permanency of home-made inks prepared by oneself is satisfactory if they are preserved from dust and air. My inks have kept for periods exceeding three months, with the most satisfactory results.

INK-GRINDING MACHINES. — For all ordinary pur-



poses the inks prepared in the manner just described are perfectly satisfactory. For inks, however, which must be extremely fine this method of mixing is not sufficient, therefore, I had a small machine constructed (Fig. 4), which consists of two rollers turning in opposite directions. The hand-ground inks are placed on these rollers and kneaded with strong pressure for two or three minutes. The whole machine is 25 cm high and 20 cm wide (10 × 8 in.), and can be conveniently fastened on the corner of any table. The resultant inks are of a fineness and quality which have not been bettered by large manufacturers.

ADDITIONS TO THE INKS.—If it is desired that the inks should dry matt on the bromoil print, so that the defatting with benzol may be omitted, then one should add to the home-made inks a small quantity of one of the following mixtures:

(a) Beeswax 1 g (15 gr.); melt by heat and add with stirring 20 drops of linseed oil. As it cools a salve-like mass is formed. Or:

(b) 1 g (15 gr.) kieselguhr (infusorial earth) rubbed up with linseed oil to a quite thin fluid paste.

It should be noted that these mixtures, in consequence of their content of linseed oil, make the inks softer.

# Books on Photography

---

Optics for Photographers, by Hans Harting, Ph.D. Translated by Frank R. Fraprie, S.M., F.R.P.S. 232 pages. Cloth, \$2.50.

Chemistry for Photographers, by William R. Flint. 2nd edition. 218 pages. Cloth, \$2.50.

Pictorial Composition in Photography, by Arthur Hammond. 234 pages, 49 illustrations. Cloth, \$3.50.

Photo-Engraving Primer, by Stephen H. Horgan. 81 pages. Cloth, \$1.50.

Cash from Your Camera. Edited by Frank R. Fraprie, S.M., F.R.P.S. 87 pages. Paper, \$1.00.

Pictorial Landscape Photography, by the Photo Pictorialists of Buffalo. 252 pages, 55 illustrations. Cloth, \$3.50.

Photographic Amusements, by Walter E. Woodbury. 9th edition. 128 pages, 100 illustrations. Cloth, \$1.50.

Practical Color Photography, by E. J. Wall, F.C.S., F.R.P.S. 248 pages. Cloth, \$3.00.

Bromoil Printing and Bromoil Transfer, by Dr. Emil Mayer. Translated by Frank R. Fraprie, S.M., F.R.P.S. 199 pages. Cloth, \$2.50.

## PRACTICAL PHOTOGRAPHY SERIES

Edited by Frank R. Fraprie, S.M., F.R.P.S.

Editor of *American Photography*

1. The Secret of Exposure.
2. Beginners' Troubles.
3. How to Choose and Use a Lens.
4. How to Make Prints in Color.
5. How to Make Enlargements.
6. How to Make Portraits.
7. How to Make Lantern Slides.
8. The Elements of Photography.
9. Practical Retouching.
10. Practical Printing Processes.
11. Modern Development.

*Each volume sold separately.* Cloth, \$1.00; paper, 50 cents.

American Photography Exposure Tables, 101st thousand. Cloth, 35 cents.

Thermo Development Chart. 25 cents.

*American Photography*, a monthly magazine, representing all that its name implies. 25 cents a copy. \$2.50 a year.

---

PUBLISHED BY

American Photographic Publishing Co.

428 Newbury St., Boston 17, Massachusetts

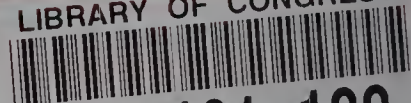








LIBRARY OF CONGRESS



0 028 131 188 8